

## iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Overview

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014)



For full technical specifications, refer to [support.apple.com/specs](https://support.apple.com/specs).

## iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Serial Number Location

The serial number for iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014) is located on the bottom of the stand. **Note:** If the computer has a VESA mount, the serial number is located on the underside of the VESA mount tongue.

When replacing the stand, use a fine-tip black permanent marker to neatly write the serial number on the bottom of the new stand. **Note:** If replacing the VESA mount tongue, write the serial number on the underside of the VESA mount tongue.





# General Troubleshooting

## Update Software and Firmware

**Important:** Before you begin troubleshooting, ensure the correct version of OS X is installed, and check for and apply the latest software and firmware updates. Computers sometimes exhibit symptoms that indicate the wrong version of OS X system software is installed. Check Apple Support article [HT1159: Mac OS X versions \(builds\) for computers](#) to make sure system build is correct for this computer model.

Firmware is the name given to software that is written into memory circuits such as flash memory, that will hold the software code indefinitely, even when power is removed from the hardware. Firmware on Intel Mac computers is designed to be updated if necessary by running the OS X Software Update check (available in the Apple () menu) while the computer is connected to the Internet.

For more information about firmware updates, refer to Apple Support articles:

- [HT1557: About firmware updates for Intel-based Macs](#)
- [HT1237: EFI and SMC firmware updates for Intel-based Macs](#)

## Troubleshooting Techniques

For more information about troubleshooting techniques, go to [ATLAS](#) > Elective Courses > OS X, and choose [OS X Mavericks: Troubleshooting Techniques](#) from the course list.

## Hardware vs. Software

To isolate a hardware issue from a software issue, refer to Apple Support article [TS1388: Isolating issues in Mac OS X](#).

To troubleshoot a software issue, refer to the following Apple Support articles:

Mac OS X v10.6 and later

- [HT3258: OS X: About the incompatible software folder](#)

Mac OS X v10.6 and earlier

- [TS1394: Troubleshooting Mac OS X installation and software updates \(Mac OS X v10.6 and earlier\)](#)
- [HT1199: Mac OS X: How to troubleshoot a software issue](#)
- [HT2186: Don't install a version of Mac OS X earlier than what came with your Mac](#)
- [HT2956: Troubleshooting Mac OS X installation from CD or DVD](#)

## iMac (2008 and later): Power-On Self-Test (POST)

Intel-based Mac computers such as the iMac rely on a combination of tones and blinking LED lights to display Power-On Self-Test (POST) error codes.

- If the computer detects out-of-specification or no Random-Access Memory (RAM), the screen will remain black but the computer will beep. This error condition may be due to physically damaged RAM, installing an incorrect type of RAM, or not having RAM installed.
- Some RAM may appear to pass POST, but still cannot be used by the operating system. In this case, the computer will display a gray screen, sound three beeps and repeat beeps until computer is turned off.
- The solution to both of these situations is to first re-seat RAM and test computer again. If RAM fails POST again, remove all installed RAM and test by installing one by one each RAM module that has been verified to work correctly on another computer (i.e., "known-good" RAM) or order new RAM.
- A sequence of tones heard at startup or a no video symptom may also be fixed by temporarily removing/replacing the backup battery.

For more information, refer to Apple Support article: [HT5860: Mac computers: About startup tones](#).

# Quick Check Procedures

## Resetting the System Management Controller (SMC)

The System Management Controller (SMC) is a chip on the logic board that controls all power functions. If the computer is experiencing any power issue, such as not starting up, not displaying video, sleep issues, or fan noise issues, resetting SMC may resolve it.

For more information and instructions to reset the SMC on different computer models, refer to Apple Support article [HT3964: Intel-based Macs: Resetting the System Management Controller \(SMC\)](#).

**Note for iMacs:** If you press the power button while inserting the power cord, the iMac will enter a mode in which the fans run at full speed. For more information, refer to Apple Support article [TS1433: iMac: Fans run at full speed after computer turns on](#).

## Resetting Parameter RAM (PRAM)

PRAM stores certain system and device settings in a location that OS X can access quickly. Exactly which settings are stored in the computer's PRAM varies depending on the type of computer as well as the types of devices and drives connected. To reset PRAM:

1. Shut down the computer.
2. Locate the following keys on the keyboard: Command, Option (Alt), P, and R. You will need to hold these keys down simultaneously in Step 4.
3. Press power button.
4. Immediately press and hold Command-Option-P-R keys.  
**Important:** You must press this key combination before the gray screen appears.
5. Hold down keys until computer restarts, and you hear startup chime a second time.
6. Release keys.

For more information, refer to Apple Support article [PH14222: OS X Mavericks: Reset your computer's PRAM](#).

## Starting Up in Safe Mode

Safe Mode is the state into which you can start up your Mac by performing a Safe Boot. Starting up into Safe Mode does several things that can help troubleshoot and resolve software or directory issues that may exist on the startup volume. To start up in Safe Mode:

1. Make sure computer is shut down.
2. Press power button.
3. Immediately after you hear startup sound, press and hold Shift key.  
**Note:** The Shift key should be held as soon as possible after startup sound but not before.
4. Release Shift key when you see the screen with a gray Apple and progress indicator (looks like a spinning gear). Note that booting into Safe Mode will take longer than a normal startup. During startup in OS X v10.4 through OS X v10.6.8, you will see "Safe Boot" on the login window, which appears even if you normally log in automatically. In OS X v10.6 and later, a gray progress bar is also displayed on the bottom of the window during Safe Boot. During startup in OS X v10.2 through v10.3.9, you will see "Safe Boot" on the OS X startup screen.
5. To leave Safe Mode, restart computer normally, without holding down any keys during startup.

For more information, refer to the following Apple Support articles:

- [HT1564: OS X: What is Safe Boot, Safe Mode?](#)
- [TS1884: Safe Boot takes longer than normal startup](#)

# Recovering a Lost Firmware Password

Only Apple Retail Stores or Apple Authorized Service Providers can unlock the following Mac models when protected by a firmware password:

- MacBook Air (Late 2010 and later)
- MacBook Pro (Early 2011 and later)
- iMac (Mid 2011 and later)
- Mac mini (Mid 2011 and later)
- Mac Pro (Late 2013)

Refer to Apple Support article [TS3554: Recovering a lost firmware password on Mac computers manufactured after October 2010](#).

## iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Diagnostic Software

	Apple Service Diagnostic (ASD)	Apple Hardware Test (AHT)	Apple Diagnostics
iMac (27-inch, Late 2012)	<a href="#">3S157</a>	<a href="#">3A244</a>	n/a
iMac (27-inch, Late 2013)	<a href="#">3S157</a>	n/a	v1.0.1 or later
iMac (Retina 5K, 27-inch, Late 2014)	use AST 2, see below	n/a	v1.0.1 or later

**Important:** If the Mac being serviced was introduced before June 2013, use Apple Hardware Test (AHT) instead of Apple Diagnostics. For more information on Apple Diagnostics, refer to [HT5781: Using Apple Diagnostics](#).

### Apple Service Toolkit 2 (AST 2)

AST 2 is a cloud-based diagnostic system to help technicians triage and verify repairs for Mac computers released in Mid 2014 and later, except for MacBook Pro (Retina 5K, Mid 2014). With AST 2, technicians will be able to initiate diagnostics wirelessly on a user's device using a Diagnostic Console (a web application on a Mac or iPad). Technicians will also be able to view diagnostic results on the Diagnostic Console.

For more information, refer to the following Apple Support articles:

- [OP476: Latest Apple Service Toolkit download links and documentation](#)
- [TP1105: AST 2 Reference Guide - Table of Contents](#)
- [TP1118: AST 2 Reference Guide - Table of Contents \(Retail\)](#)

### Apple Service Toolkit (AST)

AST is a suite of diagnostic tools that checks Intel-based Mac hardware components and provides detailed diagnostic logs for review. AST runs on a local server, managing multiple Ethernet clients via NetBoot.

For more information, refer to the following Apple Support article:

- [TP586: AST Reference Guide - Table of Contents](#)

### Mac Resource Inspector (MRI)

MRI, which is part of AST, is a quick triage tool that checks for the presence of hardware and reports sensor readings. Sensors are located on a variety of parts, including cables, fans, storage devices, the power supply, the display panel, and the logic board. Use MRI to help isolate failures and avoid unnecessary part replacements. MRI complements ASD, which is a more in-depth repair verification tool.

**Note:** If all AST checks pass and a component is still suspected to be at fault, verify with other diagnostic tools.

### iMac (27-inch, Late 2012)

Sensor	Description	Suspected Part Location	Suggested Action
IC0C	CPU Core current	On logic board	Check cable connections to logic board; test with known-good logic board.
IC0G	CPU AXG current	On logic board	Check cable connections to logic board; test with known-good logic board.
IC0I	CPU VCCIO high-side current	On logic board	Check cable connections to logic board; test with known-good logic board.
IC0M	CPU MEM 1.5V current	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
IC0S	CPU VCCSA high-side current	On logic board	Check cable connections to logic board; test with known-good logic board

ID2R	AC/DC 12V G3H current	On logic board	Check power supply cable connections to logic board; test with known-good logic board; test with known-good power supply.
IG0C	GPU Core low-side current	On logic board	Check cable connections to logic board; test with known-good logic board.
IG0F	GPU Frame buffer 1.5V high-side current	On logic board	Check cable connections to logic board; test with known-good logic board.
IH02	3.5 HDD 12V current	On logic board	Check HDD cable connections to logic board; test with known-good HDD.
IH05	3.5 HDD 5V current	On logic board	Check HDD cable connections to logic board; test with known-good HDD.
IH1R	SSD 3.3V current	On logic board	Check SSD logic board connection; test with known-good SSD/flash storage.
IM0R	DIMM 1.5 S3 current	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
IN1R	PCH 1.05V current	On logic board	Check cable connections to logic board; test with known-good logic board.
IR1R	PCH/GPU/TBT 1.05V high-side current	On logic board	Check cable connections to logic board; test with known-good logic board.
TA0p	MLB Ambient cooked temp	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
Tb0p	BLC Proximity Board temp	On logic board	Check cable connections to logic board; test with known-good logic board.
TC0p	CPU Proximity Board temp	On logic board	Check cable connections to logic board; test with known-good logic board.
TCXr	CPU Max Die temp (PECI)	On logic board	Check cable connections to logic board; test with known-good logic board.
TG0d	GPU Die cooked temp	On logic board	Check cable connections to logic board; test with known-good logic board.
TG0p	GPU Proximity temp	On logic board	Check cable connections to logic board; test with known-good logic board.
TH0O	HDD 00Bv1 Temp	Built into the HDD	Check HDD cable connections to logic board; test with known-good HDD.
TH1R	SSD 1 Gumstick OOB temp max relative	Built into SSD/flash storage	Check SSD/flash storage connection to logic board; test with known-good SSD/flash storage.
TL0p	LCD Flying Lead temp	Mounted to back of LCD display	Check LCD cable connections to logic board; test with known-good LCD display; test with known-good logic board.
TL1p	TCON Local Board temp	Built into LCD display	Check LCD cable connections to logic board; test with known-good LCD display; test with known-good logic board.
Tm0p	MLB PSU Local Board temp	On logic board	Check cable connections to logic board; test with known-good logic board.
Tm1p	MLB GPU Local Board temp	On logic board	Check cable connections to logic board; test with known-good logic board.
TM0p	SO-DIMM 1 Proximity Board temp	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
TM1p	SO-DIMM 2 Proximity Board temp	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
TM2p	SO-DIMM 3 Proximity Board temp	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
TM3p	SO-DIMM 4 Proximity Board temp	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
Tp2h	AC/DC T2 Sec heatsink temp	Built into power supply	Check power supply cable connections to logic board; test with known-good logic board; test with known-good power supply.
TPCD	PCH Die temp	On logic board	Check cable connections to logic board; test with known-good logic board.
VC0C	CPU Core voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VC0G	CPU AXG voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VC0M	CPU MEM 1.5V voltage	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
VD2R	AC/DC 12V G3H voltage	On logic board	Check power supply cable connections to logic board; test with known-good logic board; test with known-good power supply.

VG0C	GPU Core Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VH05	3.5 HDD 5V voltage	On logic board	Check HDD cable connections to logic board; test with known-good HDD.
VM0R	DIMM 1.5 S3 voltage	On logic board	Check SO-DIMMs; test with known good SO-DIMMs; test with known-good logic board.
VN1R	PCH 1.05V voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VR3R	VR 3.3V voltage	On logic board	Check cable connections to logic board; test with known-good logic board.

#### **iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014) Thermal Sensors**

Name	MRI/ASD Name	Description	Sensor Location	Suggested Action
TA0p	Ambient MLB	Ambient temperature	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
Tb0p	BLC Proximity	Backlight Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board or/and LCD panel.
TC0p	CPU Proximity O	CPU Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TCXr	ACPU Relative Die Sensor	CPU Die	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TG0d	GPU Die	GPU Die	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TG0p	GPU Proximity	GPU Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TH0O	Hard Drive Proximity	Hard Drive	Built into HDD	Check for clogged fans and/or vents; check HDD cable connections to logic board; test with known-good HDD, HDD cable, and/or logic board.
TH0o	Hard Disk Out of Band	Hard Drive Out of Band	Built into HDD	Check for clogged fans and/or vents; check HDD cable connections to logic board; test with known-good HDD, HDD cable, and/or logic board.
TH1R	SSD 1 OOB max relative	Flash Storage	Built into SSD/flash storage	Check for clogged fans and/or vents; check flash storage card connection to logic board; test with known-good flash storage card and/or logic board.
TL0p	LCD Proximity	LCD	Mounted to back of LCD display	Check for clogged fans and/or vents; check LCD connection to logic board; test with known-good LCD, LCD cable, and/or logic board.
TL1p	TCON Local	LCD Logic board	Built into LCD display	Check for clogged fans and/or vents; check LCD connection to logic board; test with known-good LCD, LCD cable, and/or logic board.
TM0p	SO-DIMM Proximity	SO-DIMM 1 Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good memory module and/or logic board.
Tm0p	MLB DIMM Local Board	MLB PSU Local	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TM1p	SO-DIMM2 Proximity	SO-DIMM 2 Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good memory module and/or logic board.
Tm1p	MLB Proximity 1 (CPU)	MLB GPU Local	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TM2p	SO-DIMM 3 Proximity	SO-DIMM 3 Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good memory module and/or logic board.
Tm2p	MLB Proximity	CPU backside sensor	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good logic board.
TM3p	SO-DIMM 4 Proximity	SO-DIMM 4 Proximity	On logic board	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good memory module and/or logic board.
Tp2h	AC/DC T2 Secondary Heatsink	Power Supply Secondary Heatsink	Built into power supply	Check for clogged fans and/or vents; check cable connections to logic board; test with known-good power supply, power supply DC cable, and/or logic board.

#### iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014) Electrical Sensors



Name	MRI/ASD Name	Description	Sensor Location	Suggested Action
ALSL	Light Sensor	Ambient Light	On camera board	Check camera cable connections; test with known-good camera, camera cable, and/or logic board.
IC0C	CPU 0 VCore Average	CPU Core Current	On logic board	Check cable connections to logic board; test with known-good logic board.
IC0M	CPU 1.35 S0	CPU Memory Current	On logic board	Check cable connections to logic board; test with known-good logic board.
ID2R	AC/DC 12V G3H current	12V DC Current	On logic board	Check DC power cable connections to logic board; test with known-good power supply and/or logic board.
IG0C	GPU 0 Core	GPU Core low-side Current	On logic board	Check cable connections to logic board; test with known-good logic board.
IG0F	GPU Frame buffer 1.5V high-side	GPU Frame buffer 1.5V Current	On logic board	Check cable connections to logic board; test with known-good logic board.
IG1C	GPU 1.8V	GPU Core high-side Current	On logic board	Check cable connections to logic board; test with known-good logic board.
IH02	3.5 HDD 12V	3.5 HDD 12V Current	On logic board	Check HDD cable connections to logic board; test with known-good hard drive, hard drive power cable, and/or logic board.
IH05	3.5 HardDrive 5V	3.5 HDD 5V Current	On logic board	Check HDD cable connections to logic board; test with known-good hard drive, hard drive power cable, and/or logic board.
IH1R	SSD 3.3V	Flash Storage Card 3.3V Current	On logic board	Check flash storage card connection to logic board; test with known-good flash storage card and/or logic board.
IM0R	Memory I-Sense	DIMM 1.5V Current	On logic board	Check SO-DIMMs; test with known-good SO-DIMMs; test with known-good logic board.
VC0C	CPU 0 Core	CPU Core Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VC0M	CPU 1.35 S0	CPU Memory Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VD2R	Power Supply 12V S0	12V DC Voltage	On logic board	Check DC power cable connections to logic board; test with known-good power supply and/or logic board.
VG0C	GPU 0 Core	GPU Core Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VG0F	GPU FB	GPU Frame Buffer Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VG1C	GPU 1 Core	GPU Core high-side Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VH05	3.5 HDD 5V	3.5 HDD 5V Voltage	On logic board	Check HDD cable connections to logic board; test with known-good hard drive, hard drive power cable, and/or logic board.
VM0R	DIMM 1.5 S3	DIMM 1.5V Voltage	On logic board	Check SO-DIMM memory modules connections to logic board; test with known-good SO-DIMM memory module and/or logic board.
VR1R	1.05V S0	1.05V Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.
VR3R	VR 3.3v	MLB 3.3V Voltage	On logic board	Check cable connections to logic board; test with known-good logic board.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Diagnostic LEDs and Test Pads



**WARNING:** Be extremely careful when working inside the computer while power is applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Be very careful not to touch tools to logic board components other than the test pads.

After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

Refer to the following Apple Support articles for more information:

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch, Late 2012 and Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Safety](#)

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014) models have four diagnostic LEDs and two pairs of test pads that can help you troubleshoot the computer without removing the logic board.

The coin battery located on the back of the logic board provides power to the real-time clock (RTC) and parameter RAM (PRAM) when the computer is not connected to an AC power source. The RTC maintains the date and time, while the PRAM stores information such as speaker volume, screen resolution, startup disk selection, and recent kernel panics. The coin battery is designed to last several years and does not normally require replacement. However, if there are issues with the functions listed above, the RTC and PRAM may need to be reset or the coin battery may need to be replaced.

## A. Diagnostic LEDs

- See the full description of LED behaviors below the locator image.

## B. Coin Battery Voltage Test Pads

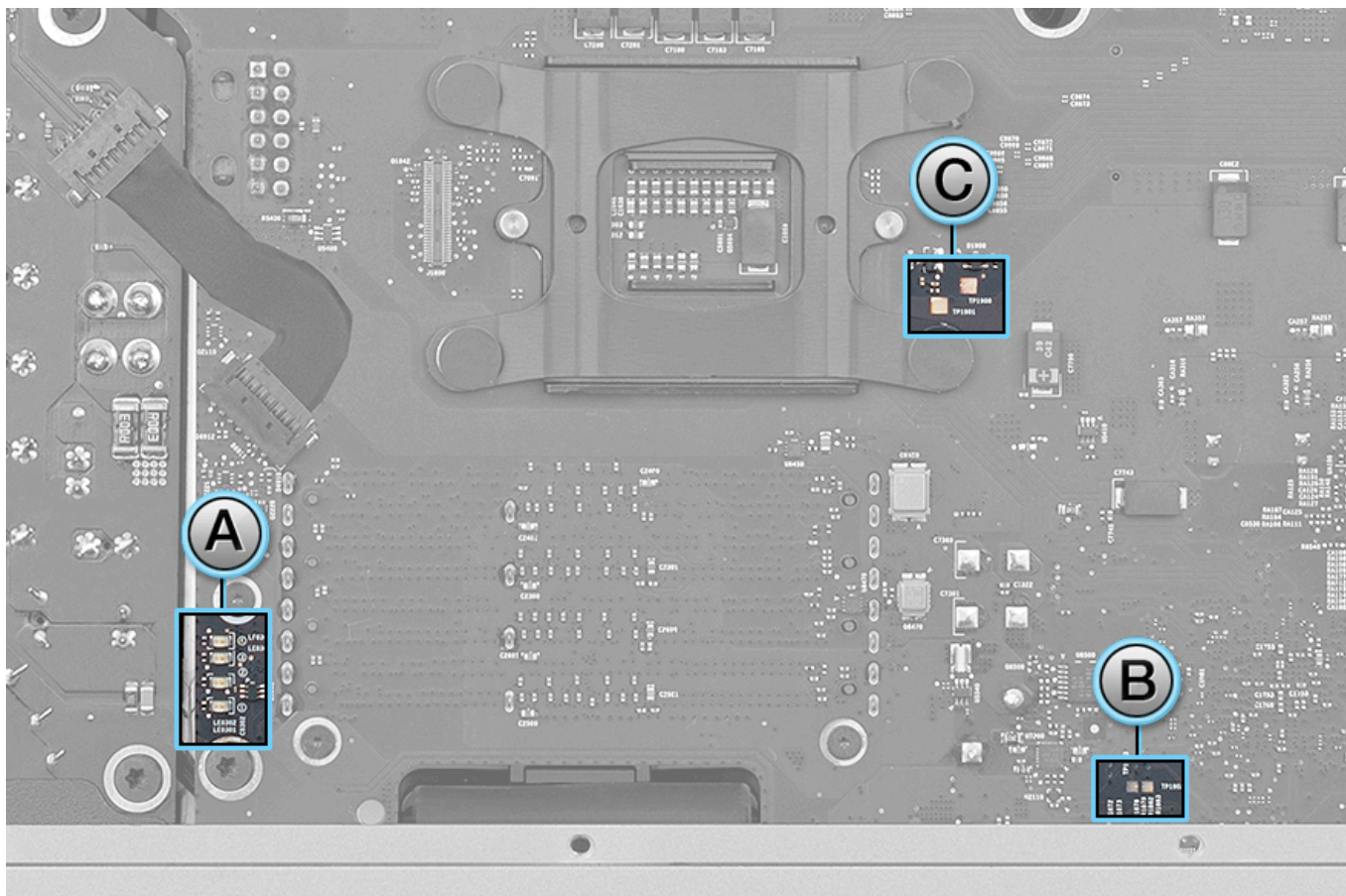
- Shut down and unplug the iMac. Allow approximately two (2) minutes for the power supply to discharge.
- Measure the coin battery voltage by using a voltmeter set for DC. Place the probes on the pads (negative probe on left pad, positive probe on right pad) in location B, shown below. If the voltage is 2.7 volts DC or less, the coin battery should be replaced.

## C. Real-Time Clock (RTC) Reset Pads

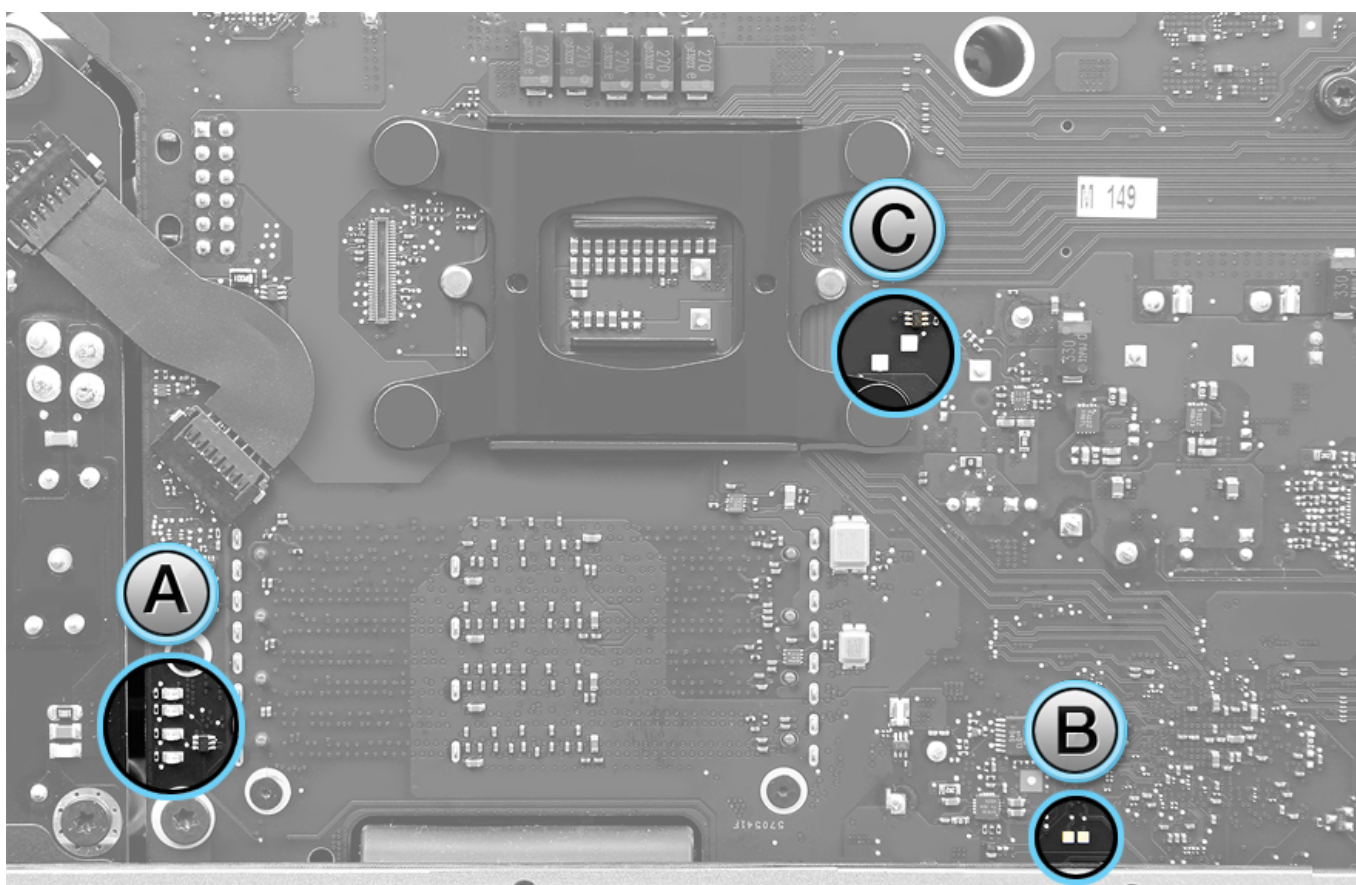
**Important:** Do not make contact with any of the surrounding components or traces while performing this procedure. Some of the smaller components can be knocked off very easily. Physically damaged boards warrant a logic board replacement.

- Shut down and unplug the iMac. Allow approximately two (2) minutes for the power supply to discharge.
- Reset the RTC by shorting the pads in location C, shown below. Use the tip of a flat-blade screwdriver to touch both pads at the same time.

## iMac (Retina 5K, 27-inch, Late 2014) LEDs and Test Pads

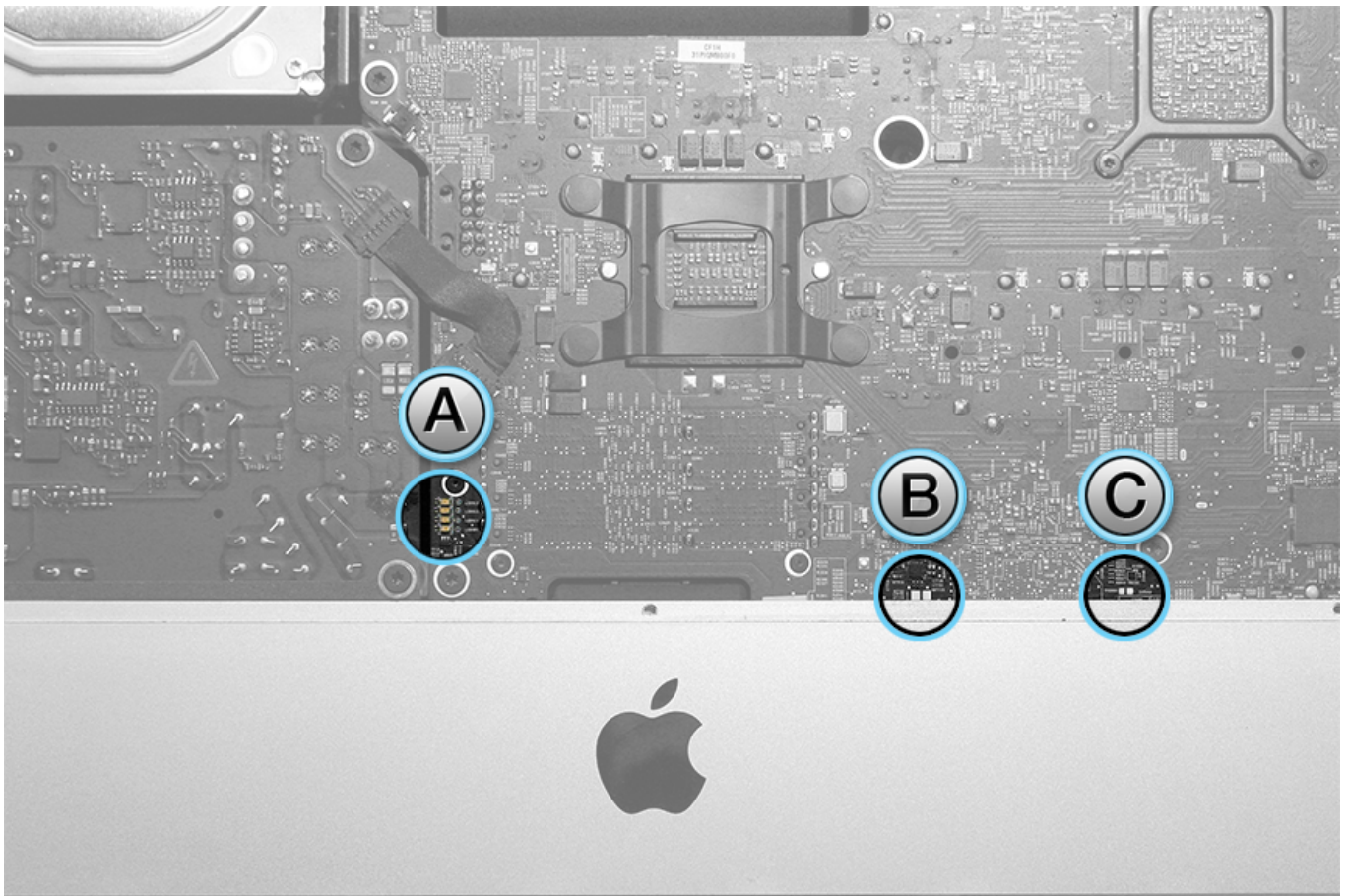


**iMac 27-inch, Late 2013) LEDs and Test Pads**



**iMac (27-inch, Late 2012) LEDs and Test Pads**





## Diagnostic LEDs (A)

### LED 1

- Indicates that the trickle voltage from the power supply has been detected by the main logic board. This LED will turn on when you connect the iMac to a working AC power source. The LED will remain on as long as the computer is on or asleep.
- When the computer has been shut down correctly, LED 1 behavior may differ:
  - If a startup event is scheduled in System Preferences/Energy Saver, LED 1 will stay on after a correct shutdown.
  - If no startup event is scheduled in System Preferences/Energy Saver, LED 1 will turn off and will stay off as long as the power cord is kept connected and an AC power source is present. Disconnecting the power cord and plugging it back in will turn this LED back on, even if the computer is still off.
- After disconnecting and reconnecting the AC power source, this LED could remain off:
  - If the AC power source is missing or disconnected.
  - If the logic board is disconnected from the power supply or the AC receptacle.
  - If the power supply board is faulty.

### LED 2

- Indicates that the computer is turned on. This LED will be on as long as the computer is turned on (but is not asleep) and the power supply and voltage regulators are working correctly.

### LED 3

- Indicates that the computer and video card are communicating. This LED will be on when the computer is communicating properly with the video card. If LEDs 1 and 2 are on and you heard the startup sound but LED 3 is off, the backup battery (on back of logic board) may need to be reseated or the video card might be installed incorrectly or need replacement.

### LED 4

- Indicates that the computer and LCD panel are communicating. This LED will be ON when the computer is turned on and a video signal is being generated. If LED 4 is on and there is no image on the display, the LCD panel or the cables between the LCD and logic board might be installed incorrectly or need replacement.

## LED Startup Sequence

**LED 1 = Power is available.**

If no LED is visible:

- Disconnect the power cord from the computer and wait 15 seconds to reset the power supply and LED status. Reconnect the power cord and check the LED status again.
- Verify the AC source.
- Verify that a known-good power cord is connected.
- Verify the cable connection between the AC inlet and the power supply.
- Verify the cable connection between the power supply and the logic board.
- Verify the power supply.

**LED 1 + LED 2 = Power is available and the system is turned on.**

If the second LED is not visible when the power button is pressed:

- Verify that the power button is connected to the power supply.
- Verify power button functionality.
- Verify the cable connection between the power supply and the logic board.
- Verify the power supply.
- Verify the logic board.

**LED 1 + LED 2 + LED 3 = Power is available, the system is turned on, and the GPU was found.**

If the third LED is not visible after the system is turned on:

- Verify whether the boot chime is present and fans are running when turned on (reset the SMC and PRAM and verify backup battery voltage for proper startup).
  - If the POST boot chime is not heard, go to the No Startup symptom flow.
  - If the POST boot chime is heard, go to the No Video symptom flow.

**LED 1 + LED 2 + LED 3 + LED 4 = Power is available, the system is turned on, the logic board is communicating with the GPU, and the internal LCD was found.**

If the fourth LED is not visible after the system is turned on:

- Verify the internal DisplayPort cable (eDP) connections between the LCD panel and the logic board.
- Inspect the LCD display cables for cable damage.
- Verify external video functionality and proceed according to the result:
  - If an external display works, verify/replace the LCD panel.
  - If an external display does not work, verify/replace the logic board.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit

Use the display extension cable kit to:

- Test the system and/or panel before securing the panel to the Very High Bond (VHB) strips.
- Test the functionality of the panel's Embedded DisplayPort cable (eDP cable).



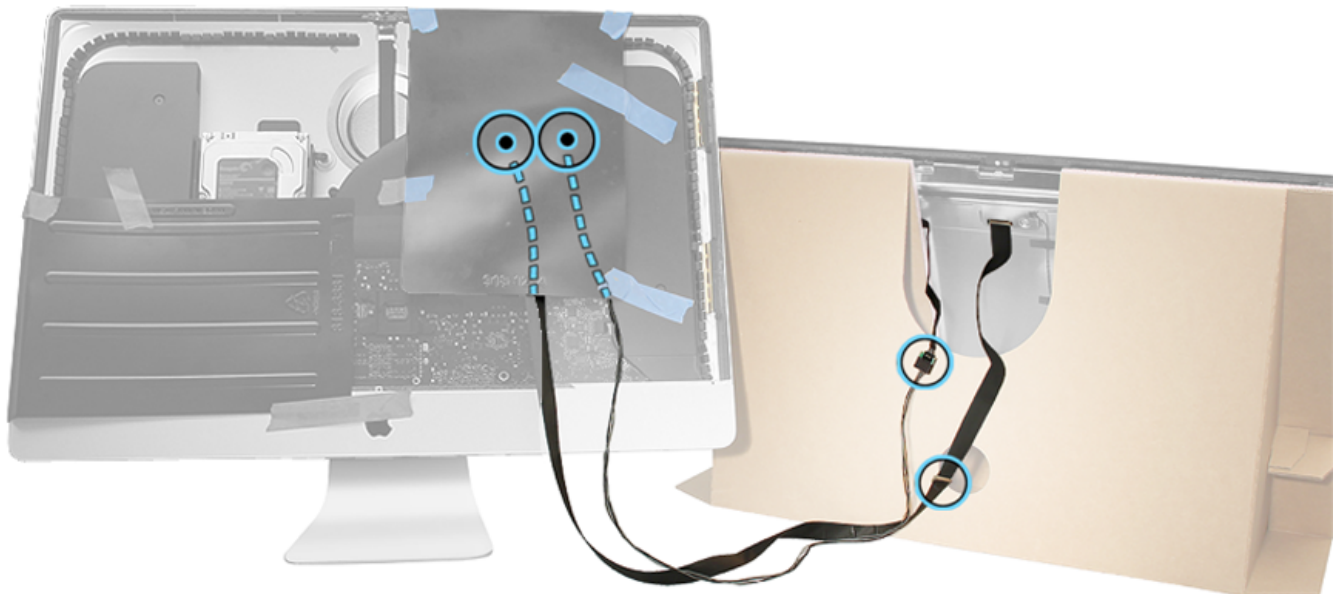
**Warning: HIGH VOLTAGE:** Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, because the power supply retains a charge whether or not the computer is on.

**After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.**

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When the computer is plugged in, the power supply and logic board are energized, even when the computer is powered off.
- Unplug the computer and, when possible, allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Refer to the following Apple Support articles for more safety information:

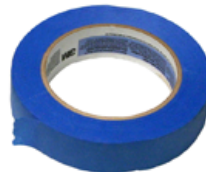
- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch, Late 2012 and Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Safety](#)



## Tools

- ESD wrist strap and mat
- Black stick
- Power supply protective covers, pack of 2 (923-0189)
- LCD service support stand, iMac (923-0416)
- Kit, display extension cable set (076-1431) for iMac (27-inch, Late 2012 and Late 2013)
- Kit, display extension cable set (076-00010) for iMac (Retina 5K, 27-inch, Late 2014)

- Painter's tape



eDP Extension Cable



BLC Extension Cable



eDP Substitution Cable

**Note:** The iMac (27-inch, Late 2013) display and extension cable kit are shown for the procedures. Follow the same setup steps and procedures if testing the iMac (Retina 5K, 27-inch, Late 2014) display, but use Display Extension Cable Set Kit 076-000010.

### Procedure #1: Testing with the System With the Panel Off, Using Extension Cables

This procedure allows you to test the system with the panel off, to ensure that everything is functioning before securing the panel with VHB strips.

#### First Steps

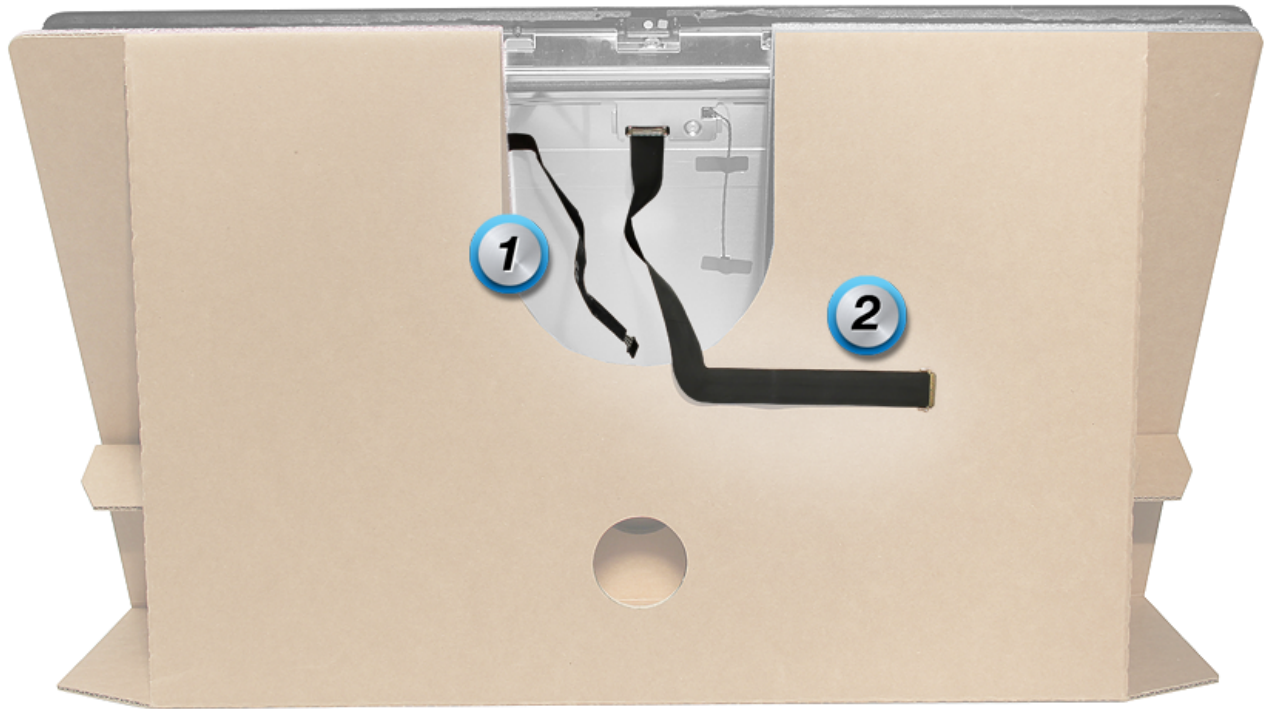
- [Display Panel Removal](#)
- [Display Panel - Removing Very High Bond \(VHB\) Strips](#)

1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the LCD backlight cable (#1) and Embedded DisplayPort (#2) cable are facing you.

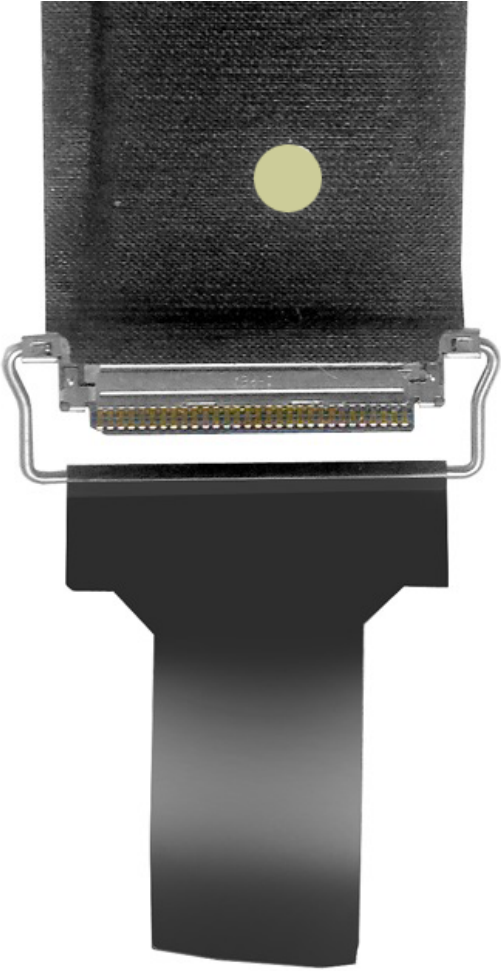







3. Locate the Embedded DisplayPort (eDP) extension cable in the kit.



4. **Important:** Each end of the eDP extension cable has a gold dot to indicate cable orientation. Orient the cable with the gold dot side up when connecting the eDP extension cable to the logic board connector and the end of the LCD eDP cable. Connecting cables upside down (with the brass connector facing up) will damage the logic board and/or the LCD panel. **Note:** With proper care, cables will last for approximately 50 insertions. After 50 insertions, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).

Correct Orientation (Gold Dot Side Up)	Incorrect Orientation (Brass Side Up)
	

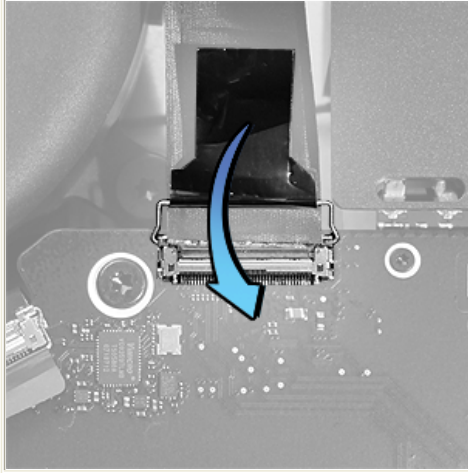
5. Flip the black tab up before connecting the eDP extension cable to the logic board connector.

Flip Tab Up	Ready to Insert
	

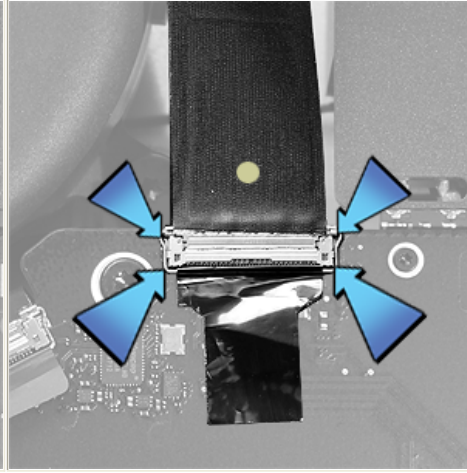
6. Connect the extension cable to the logic board connector. The cable should be aligned straight on with the connector, never inserted at an angle. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever without the black tab may cause damage to the logic board and/or the LCD panel.

- Verify that both ends of the cable have the gold dot side facing up.
- Check that the connector is fully seated.
- Flip the black tab down.
- Press the locking lever to secure the cable to the logic board.

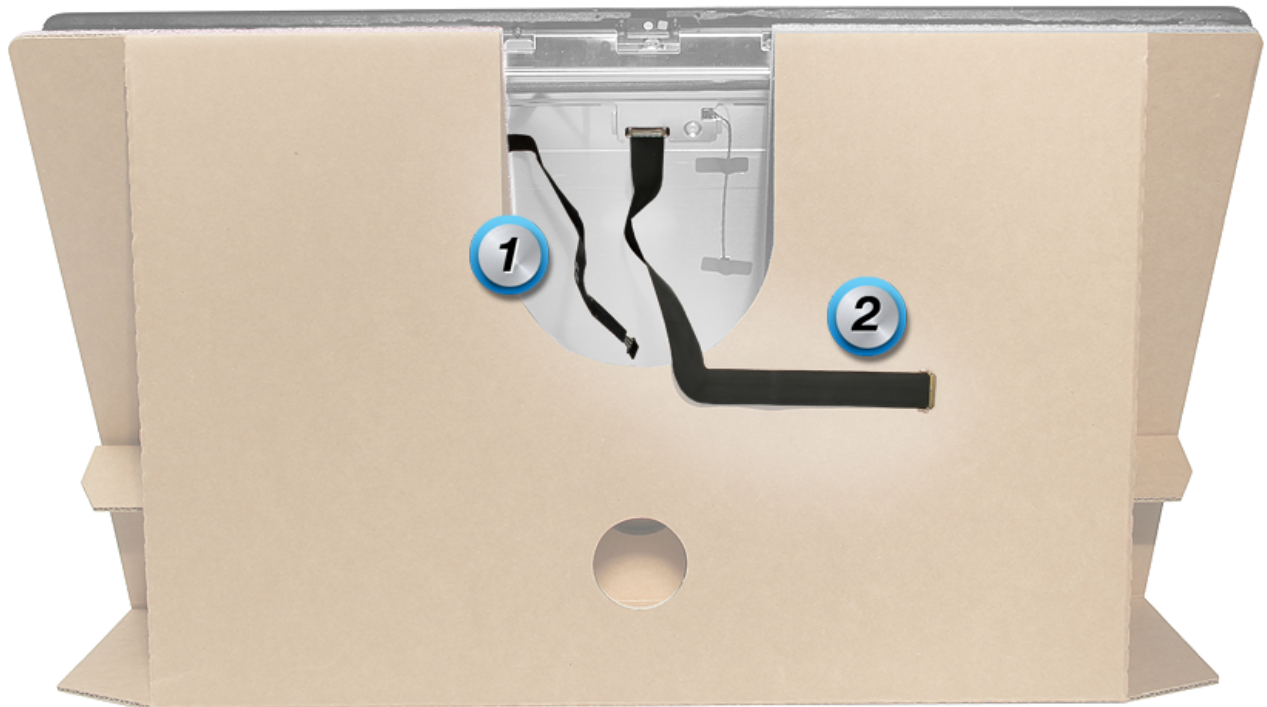
**Flip Tab Down**



**Press Locking Lever To Secure Connector**

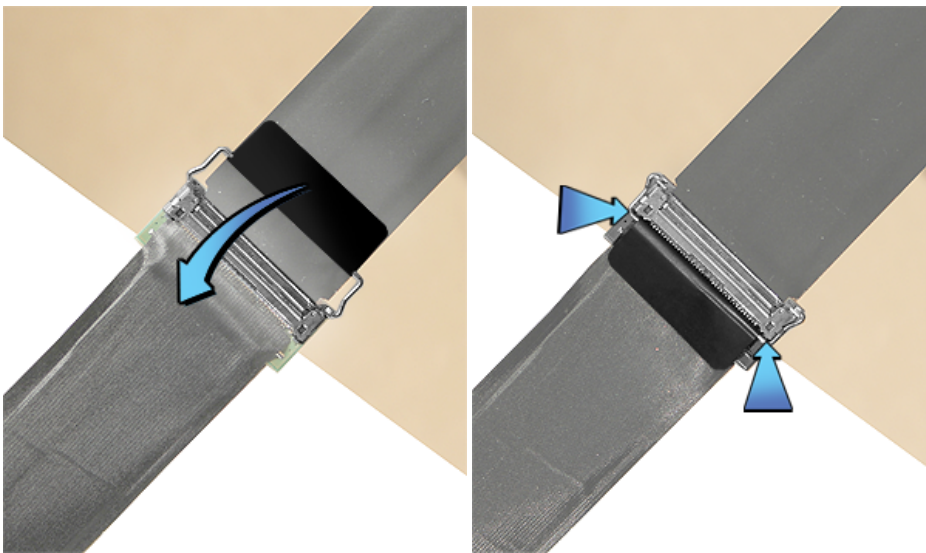


7. Secure the logic board end of the eDP extension cable to the speaker with painter's tape (see step 10).
8. Connect the other end of the eDP extension cable to the end of the dangling DisplayPort cable (#2).



9. Securely mate the cable connectors. Flip the black tab over and press the locking lever bar around the connector to secure the cables.





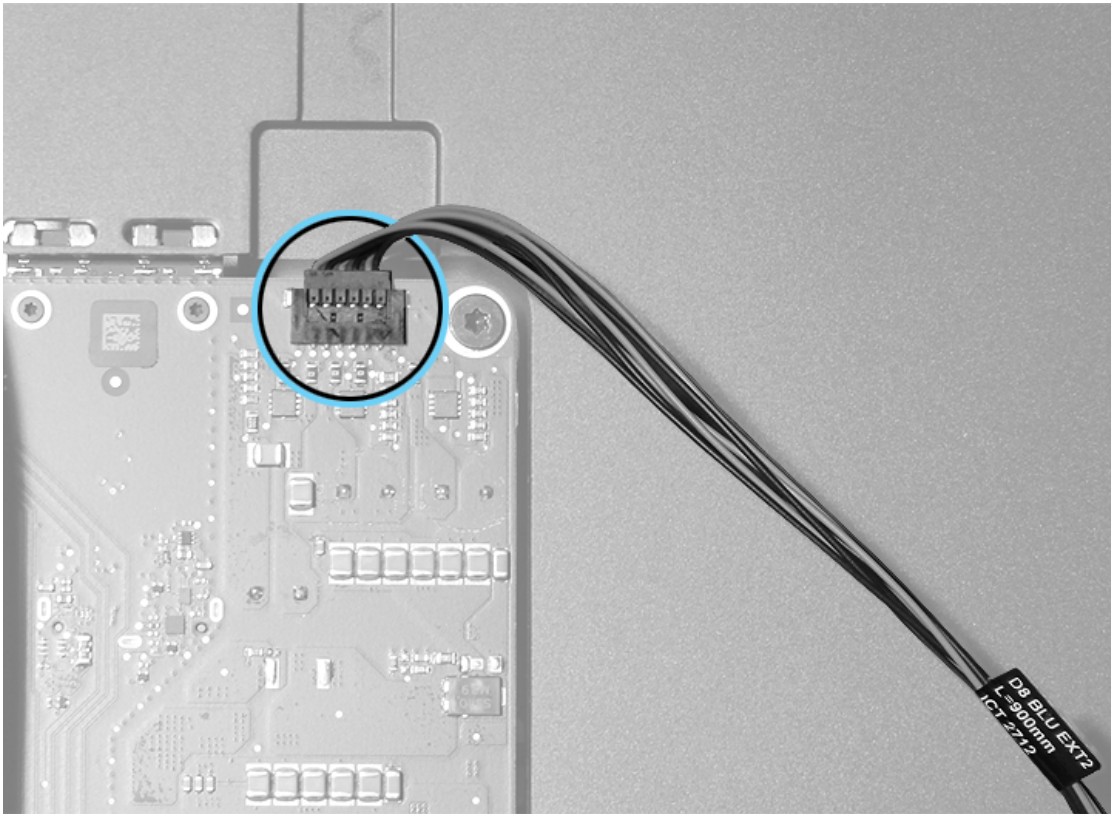
10. The eDP extension cable will look like the image below when connected properly.



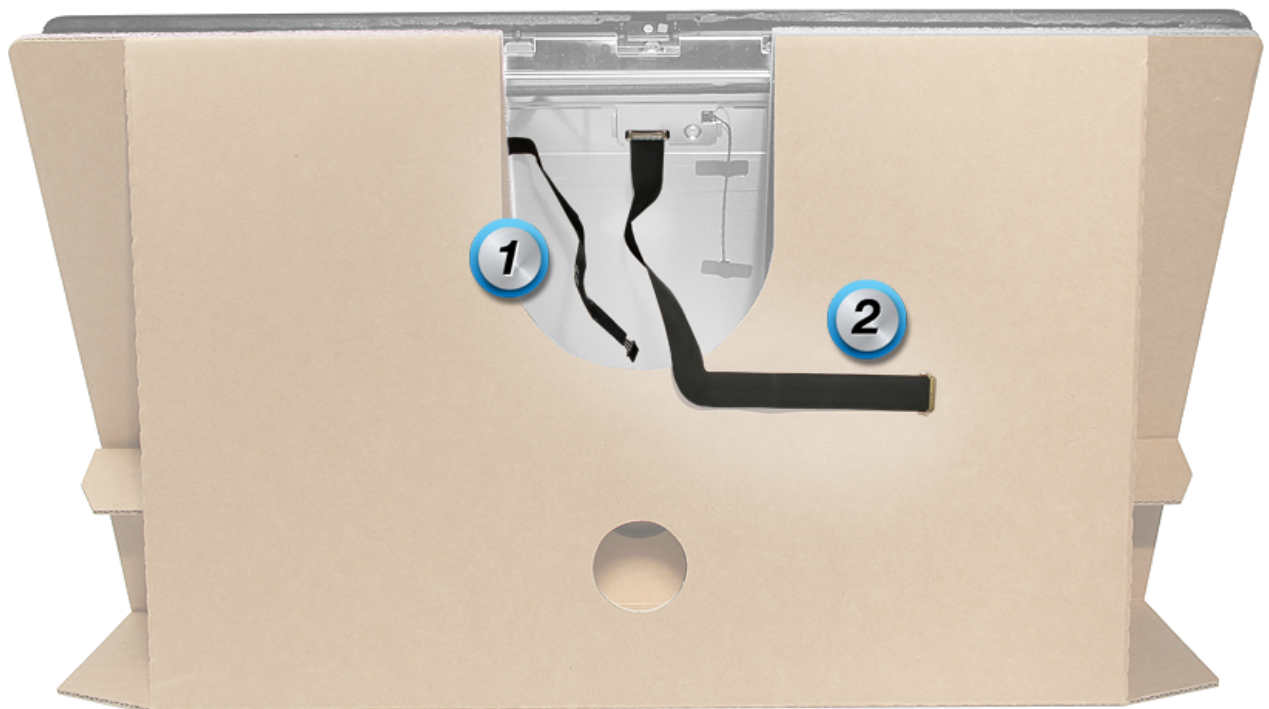
11. Next, locate the backlight extension (BLC) cable.



12. Connect the backlight extension cable to the backlight connector on the logic board.

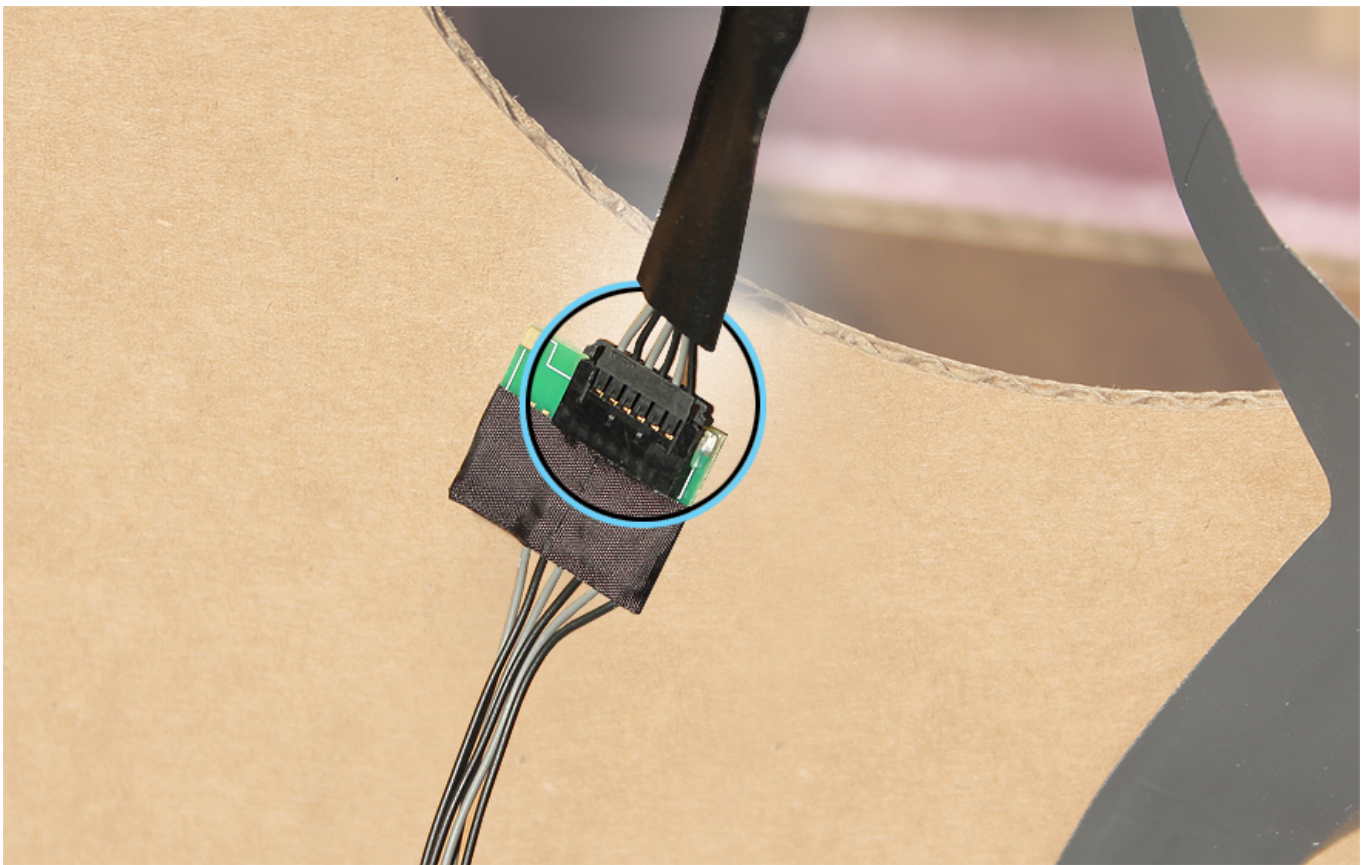


13. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).



14. Securely mate the backlight extension cable with the panel's backlight cable connector.





15. Locate the two power supply covers. Position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. Proper eDP and backlight extension cable setup is shown below.



16. Attach the power cord to the iMac and start up the system to verify system functionality.

#### **Procedure #2: Testing the Panel with the eDP Substitution Cable**

This procedure tests an eDP cable to determine whether the issue is with the eDP cable. Remove the "suspect" eDP cable from the circuit and replace it with the eDP substitution cable.

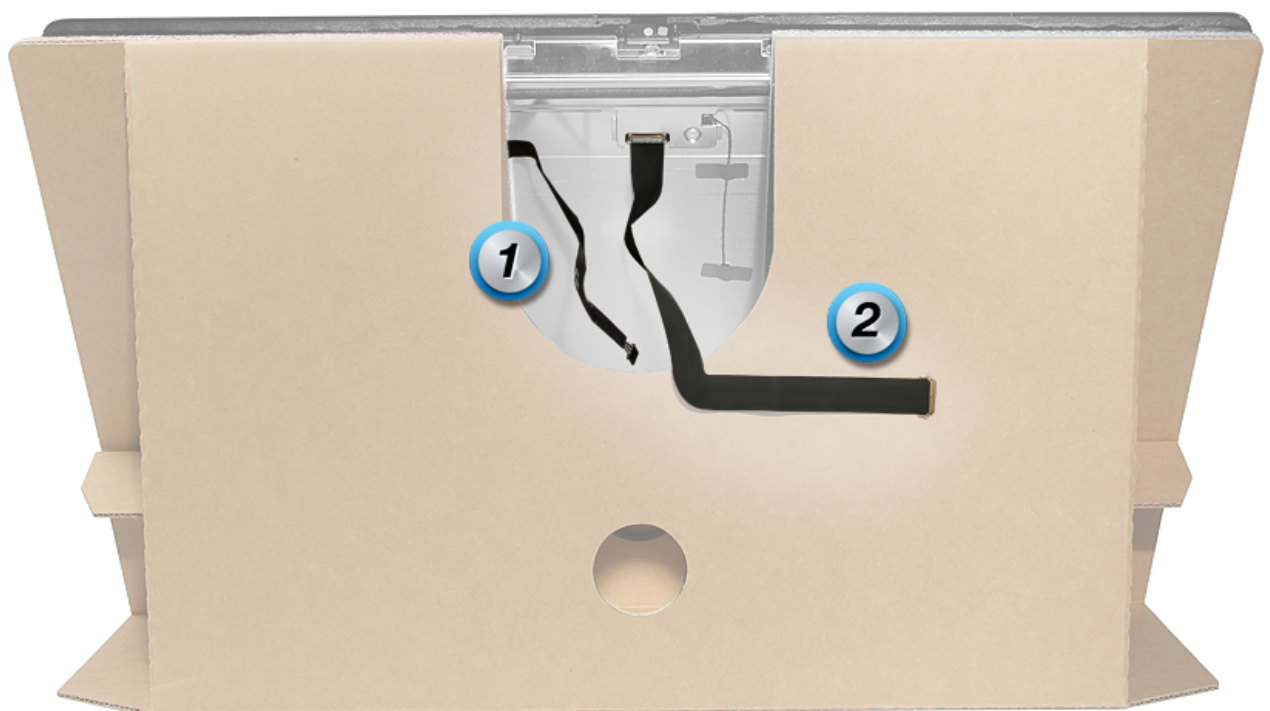
#### **First Steps**

- [Display Panel Removal](#)
- [Display Panel - Removing Very High Bond \(VHB\) Strips](#)

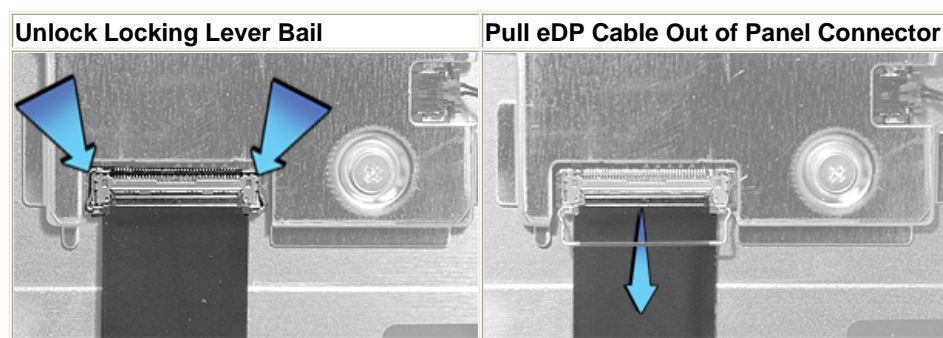
1. Place the LCD panel on the service support stand.



2. Orient the service support stand so the backlight cable (#1) and Embedded DisplayPort (#2) cable are facing you.



3. Disconnect the Embedded DisplayPort cable from the connector on the LCD panel. Use your fingernail to flip the locking lever bail.



4. Locate the Embedded DisplayPort substitution cable.



5. Either end of the cable can connect to the logic board; the other end connects to the display. **Important:** Each end of the eDP substitution cable has a gold dot to indicate the cable orientation. Orient the cable with the gold dot side up when connecting the eDP substitution cable to the logic board and to the connector on the LCD panel. Connecting the cable upside down (with the brass connector facing you) will damage the logic board and/or the LCD panel.

**Note:** With proper care, cables will last for approximately 50 insertions. After **50 insertions**, cable degradation may occur and Apple recommends ordering a new Display Extension/Substitution Cable Kit (refer to the Tools section above).

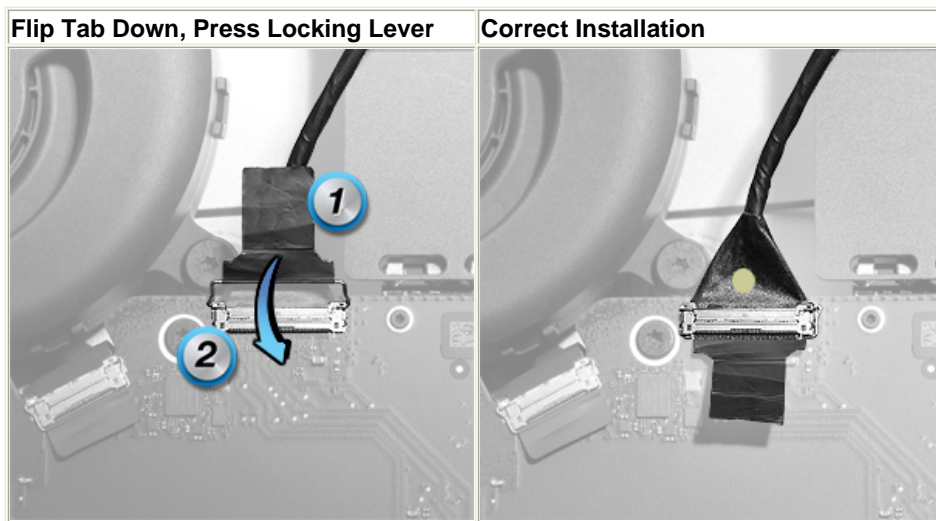


6. Connect one end of the eDP substitution cable to the connector on the logic board. The cable should be aligned straight on with the connector, never inserted at an angle. The eDP substitution cable is shown properly connected to the logic board. **Important:** Ensure that the black tab is attached to the locking lever on the eDP cable. Attaching the locking lever



without the black tab may cause damage to the logic board and/or the LCD panel.

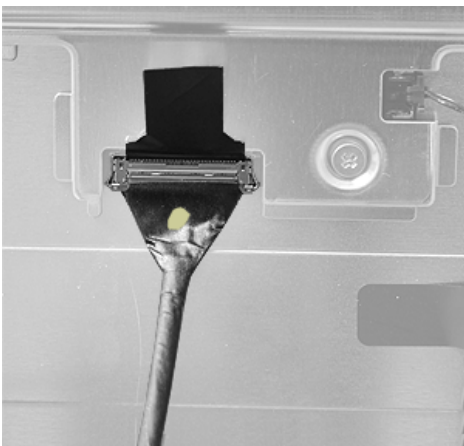
- Verify that each end of the cable has the gold dot side facing up.
- Check that the connector is fully seated.
- Flip the black tab down (#1).
- Press the locking lever (#2) to secure the cable to the logic board.



7. Connect the other end of the eDP substitution cable to the eDP connector on the back of the LCD panel.



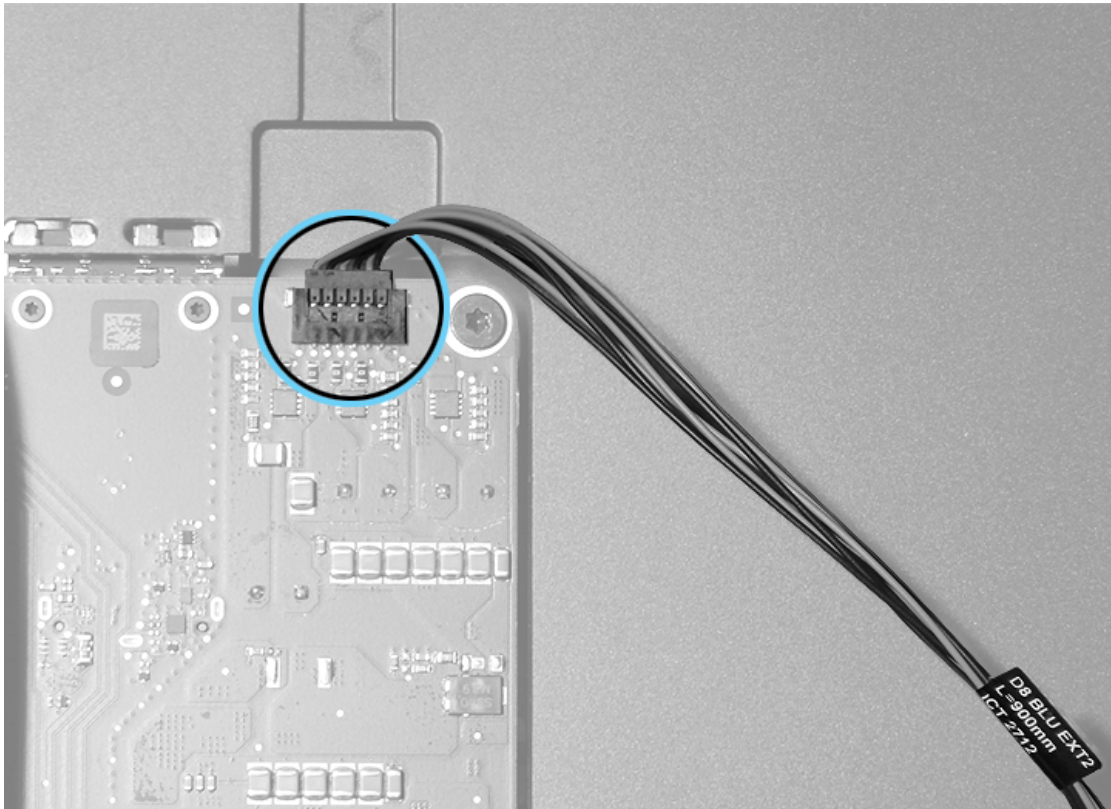
8. Flip the black tab up and press the locking lever bar securely around the connector on the panel.



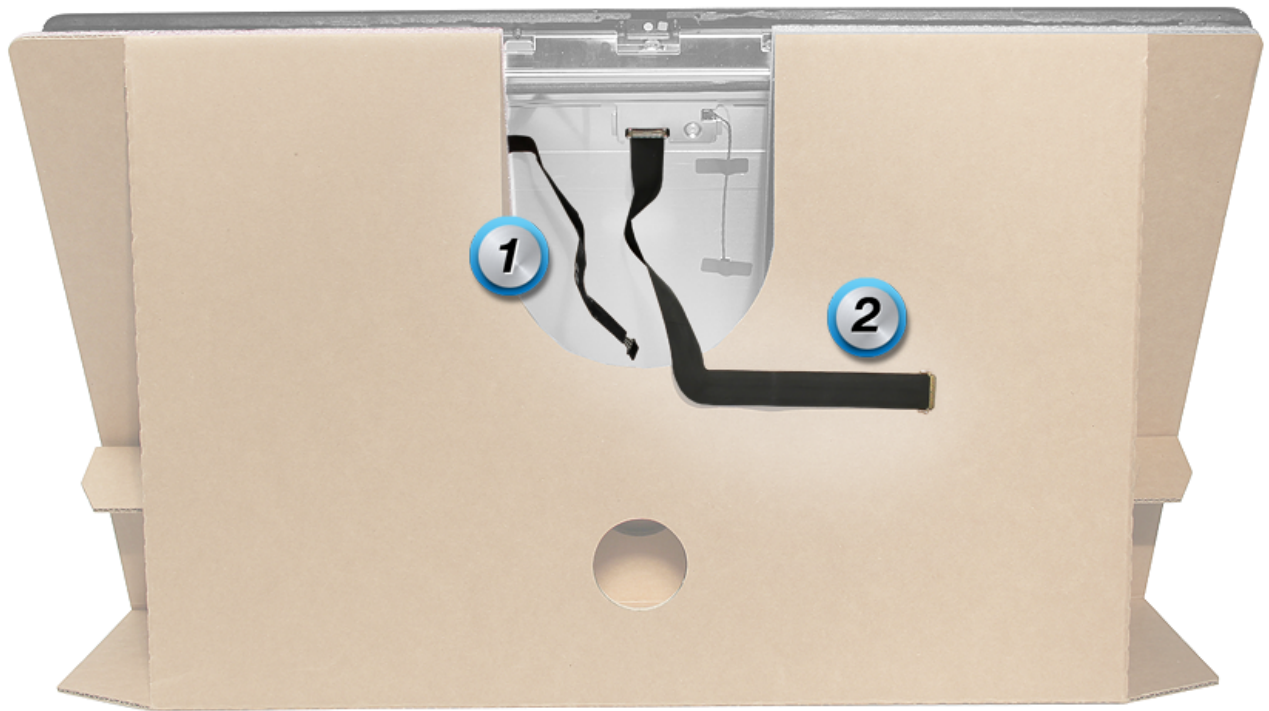
9. Next, locate the backlight extension (BLC) cable.



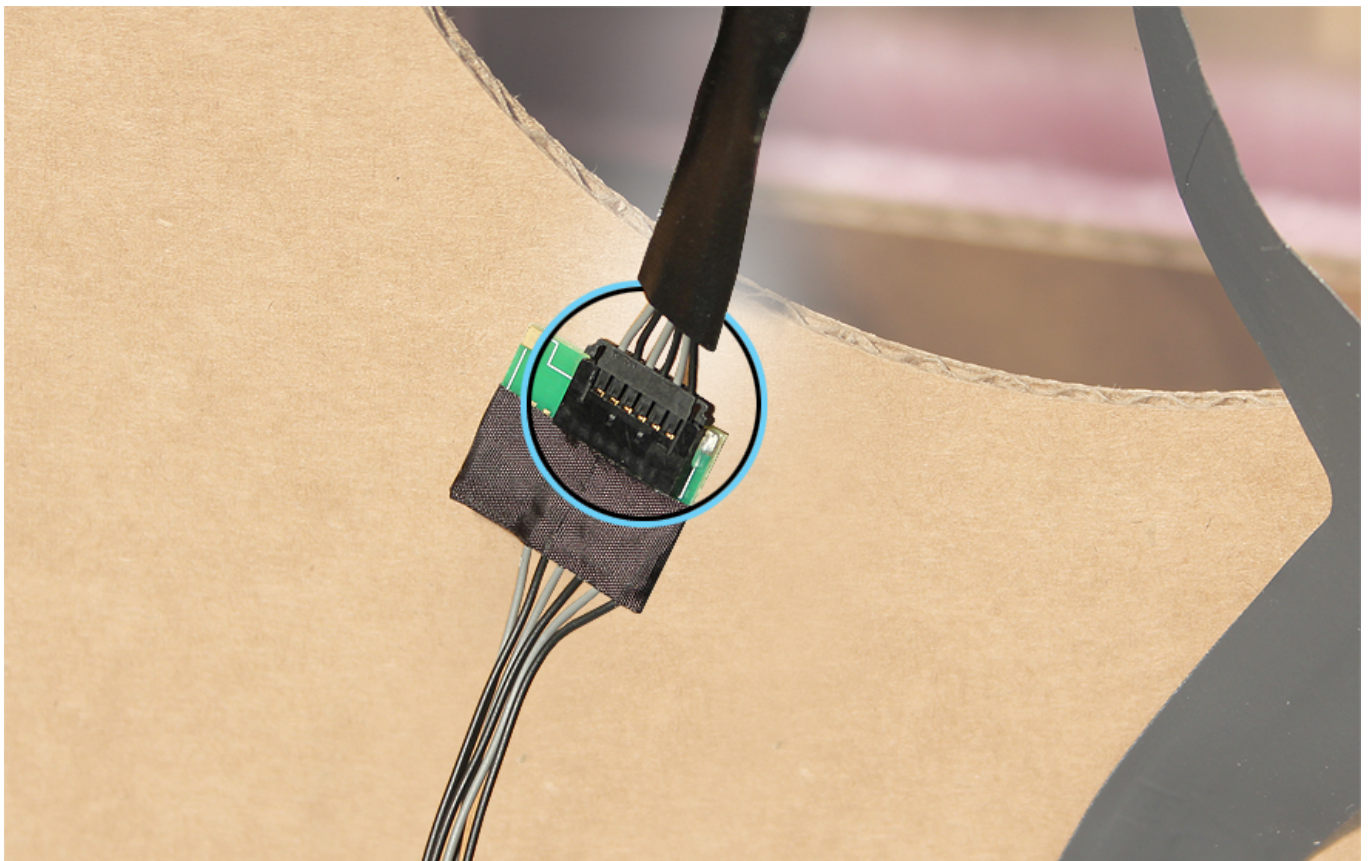
10. Connect the backlight extension cable to the backlight connector on the logic board.



11. Connect the other end of the backlight extension cable to the dangling end of the LCD backlight cable (#1).

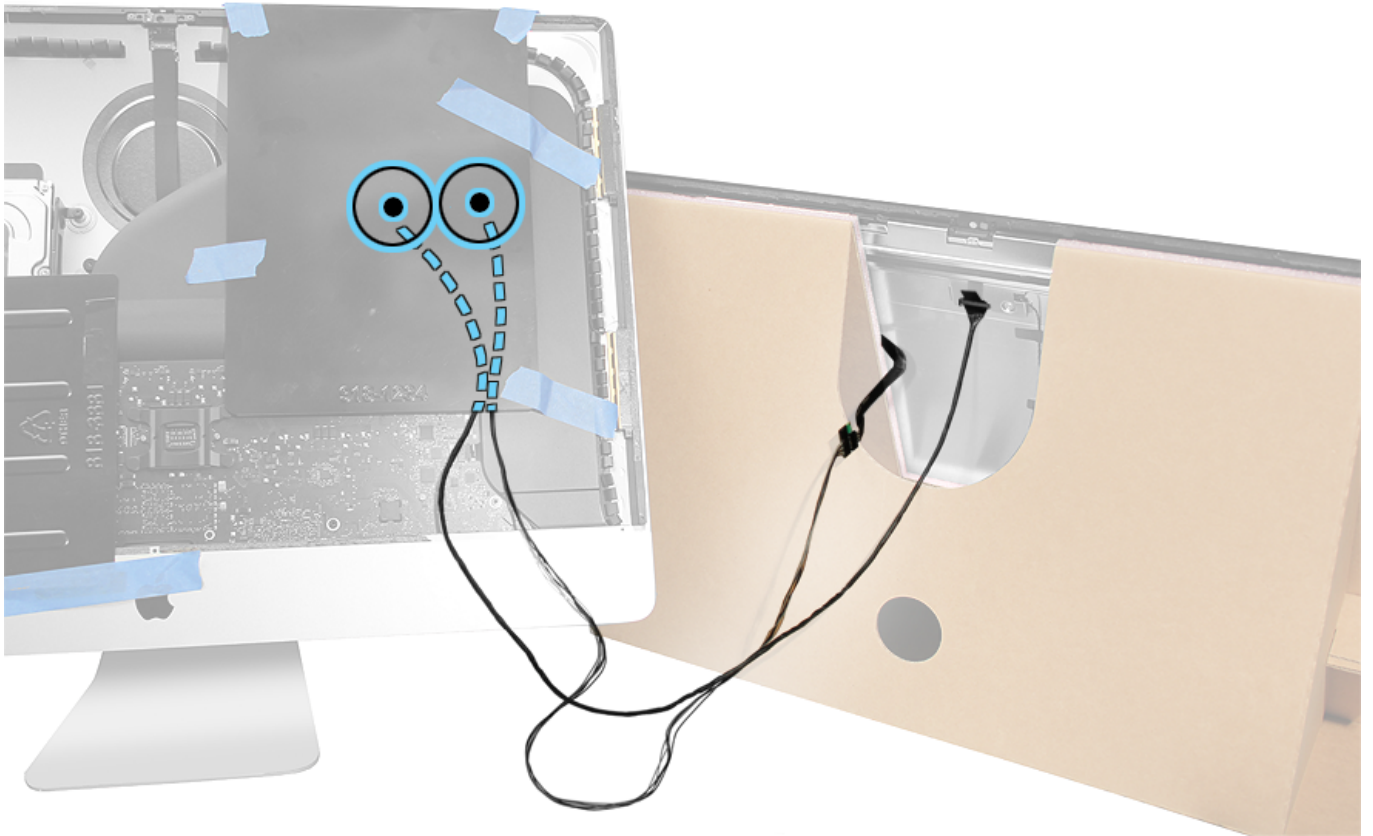


12. Securely mate the backlight extension cable with the panel's backlight cable connector.



13. Locate the two power supply covers. Position one horizontally over the power supply and one vertically over the logic board and cables. Tape the power supply covers securely to the rear housing. The image below shows the proper cable setup for the eDP substitution cable and the backlight extension cable.



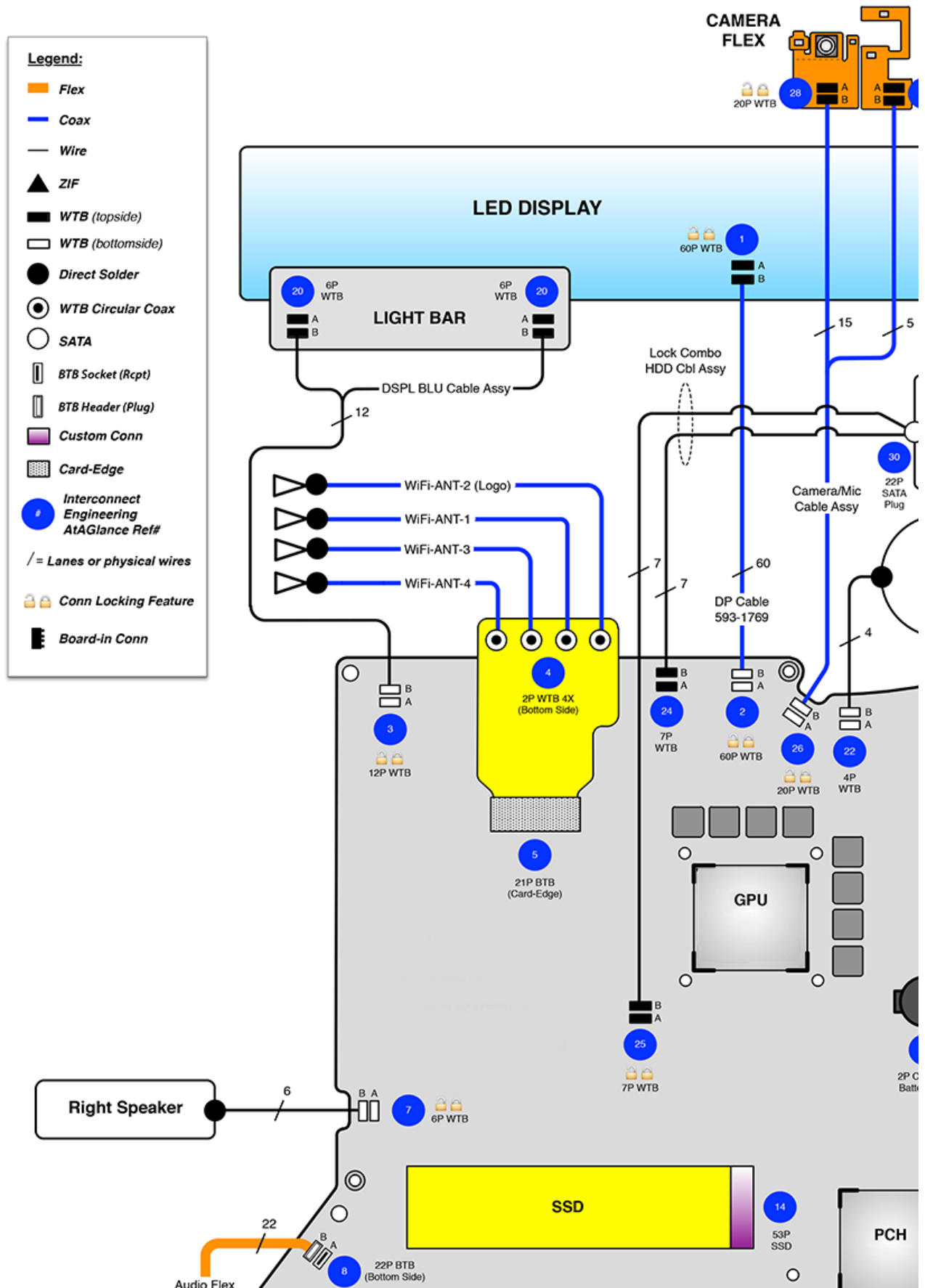


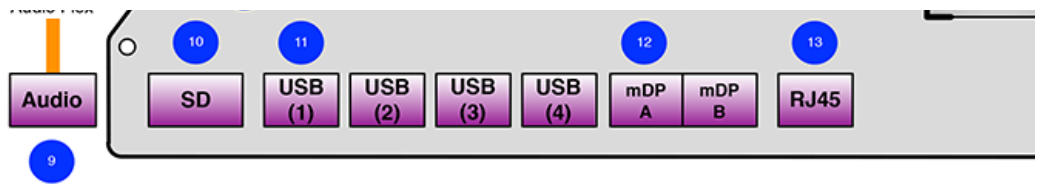
14. Attach the power cord to the iMac and start up the system to verify eDP cable functionality.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Interconnect Diagram

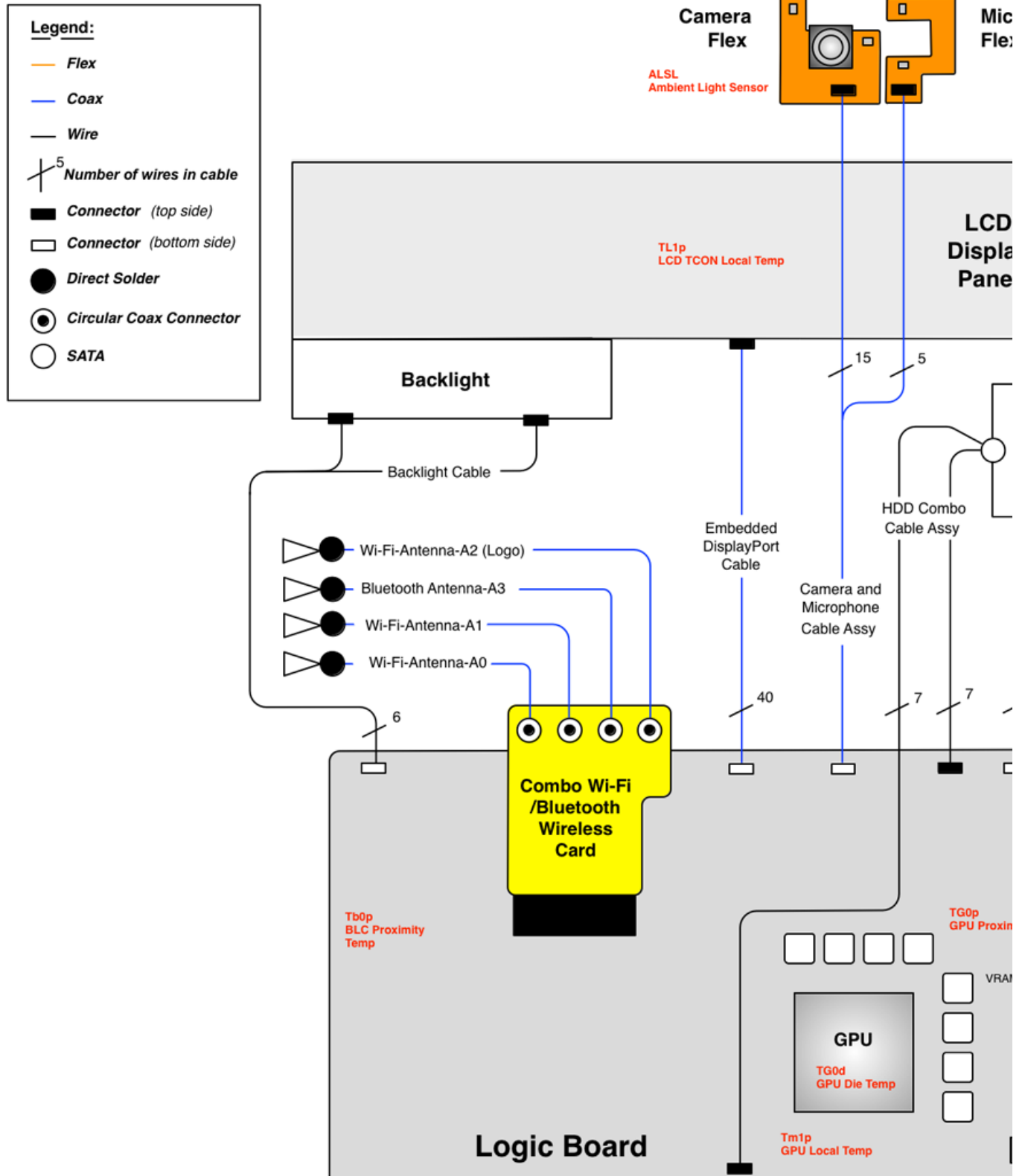
Thermal sensors and cable connector locations are shown below.

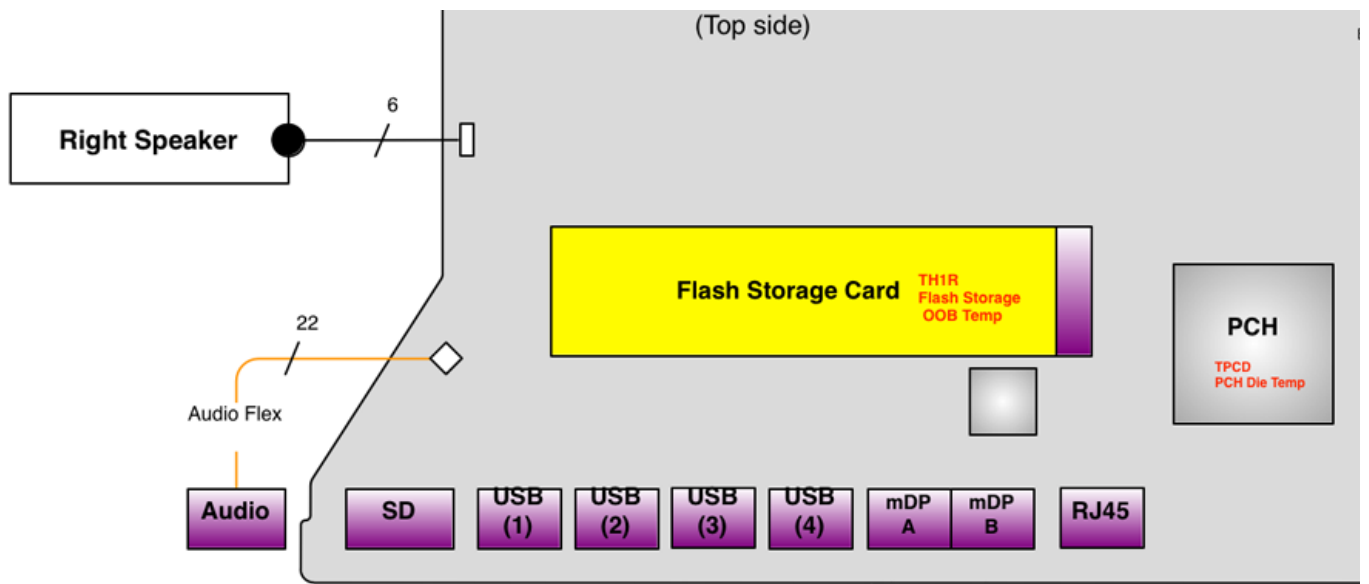
## iMac (Retina 5K, 27-inch, Late 2014)





## iMac (27-inch, Late 2013)

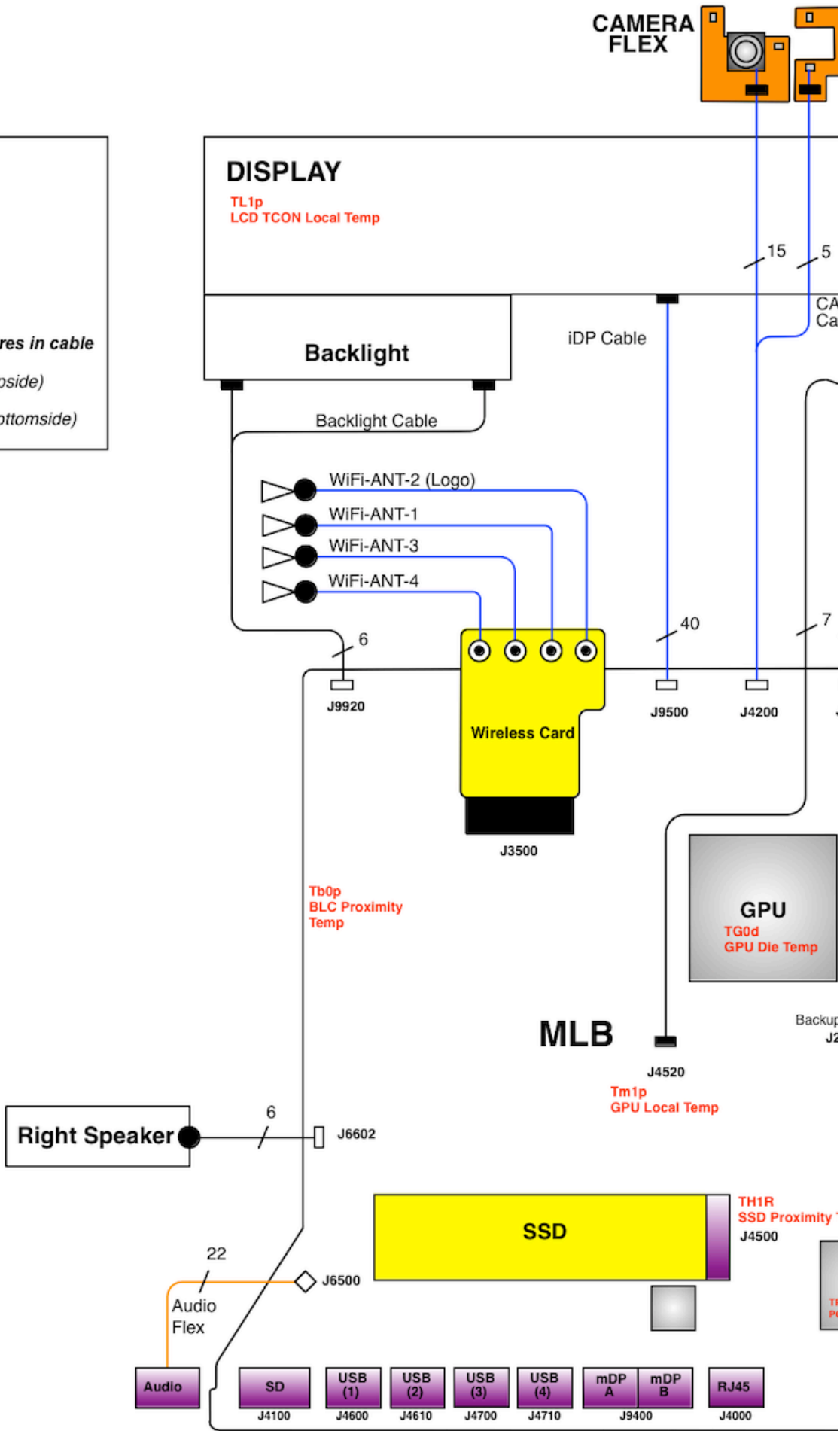




iMac (27-inch, Late 2012)

**Legend:**

- Flex
- Coax
- Wire
- Number of wires in cable
- Connector (topside)
- Connector (bottomside)

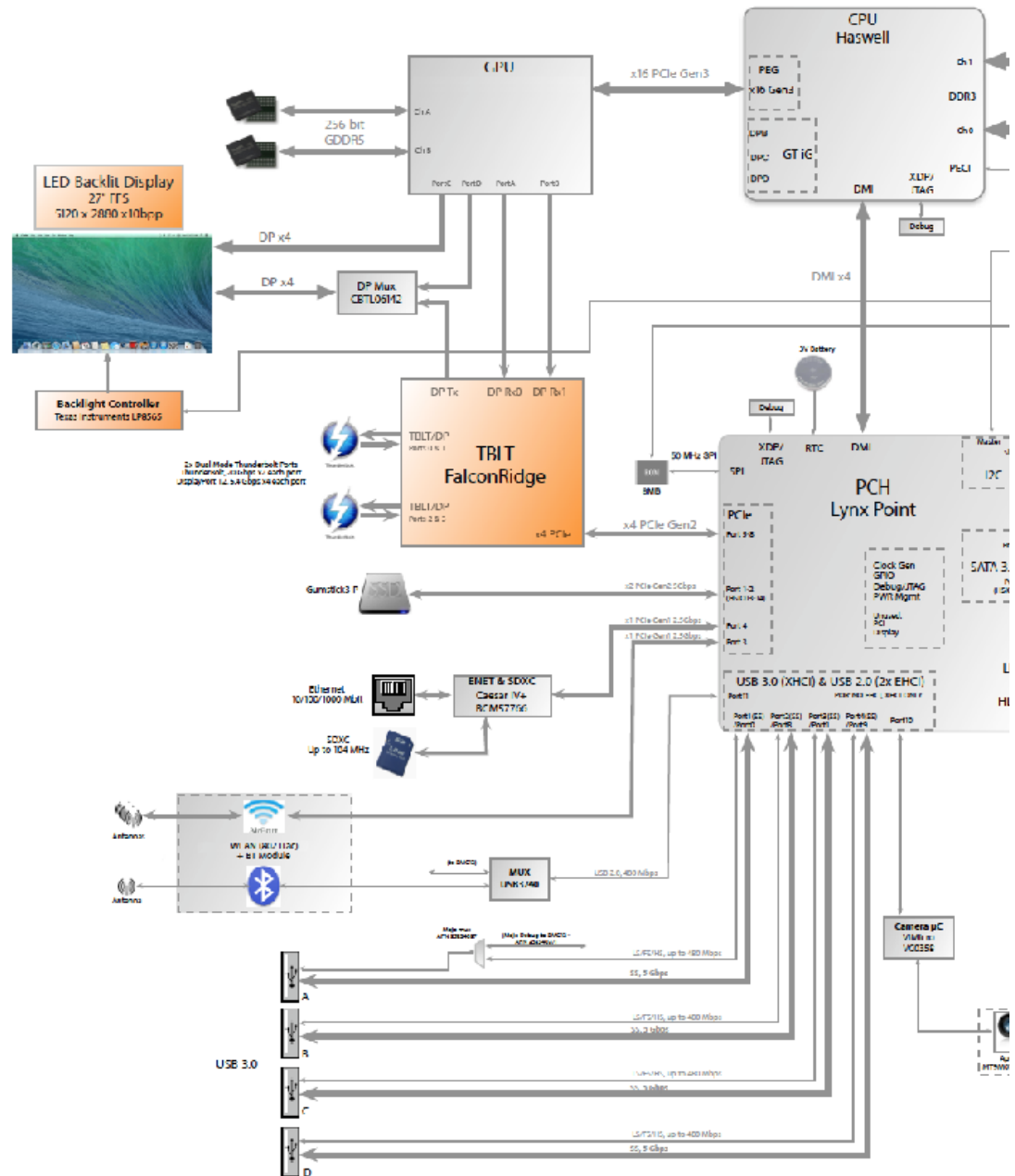




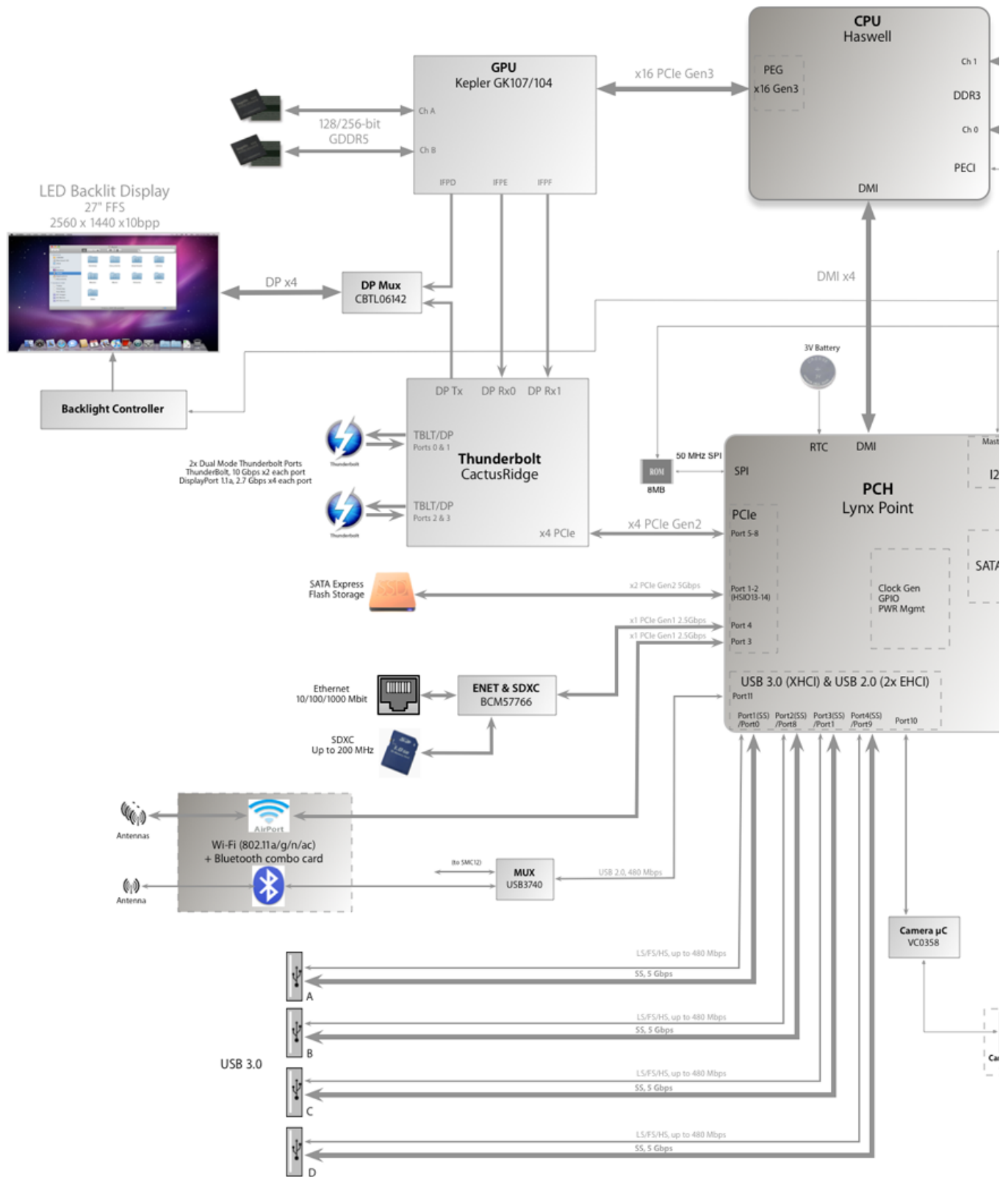
# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Block Diagram

Refer to this diagram to see how modules are interrelated.

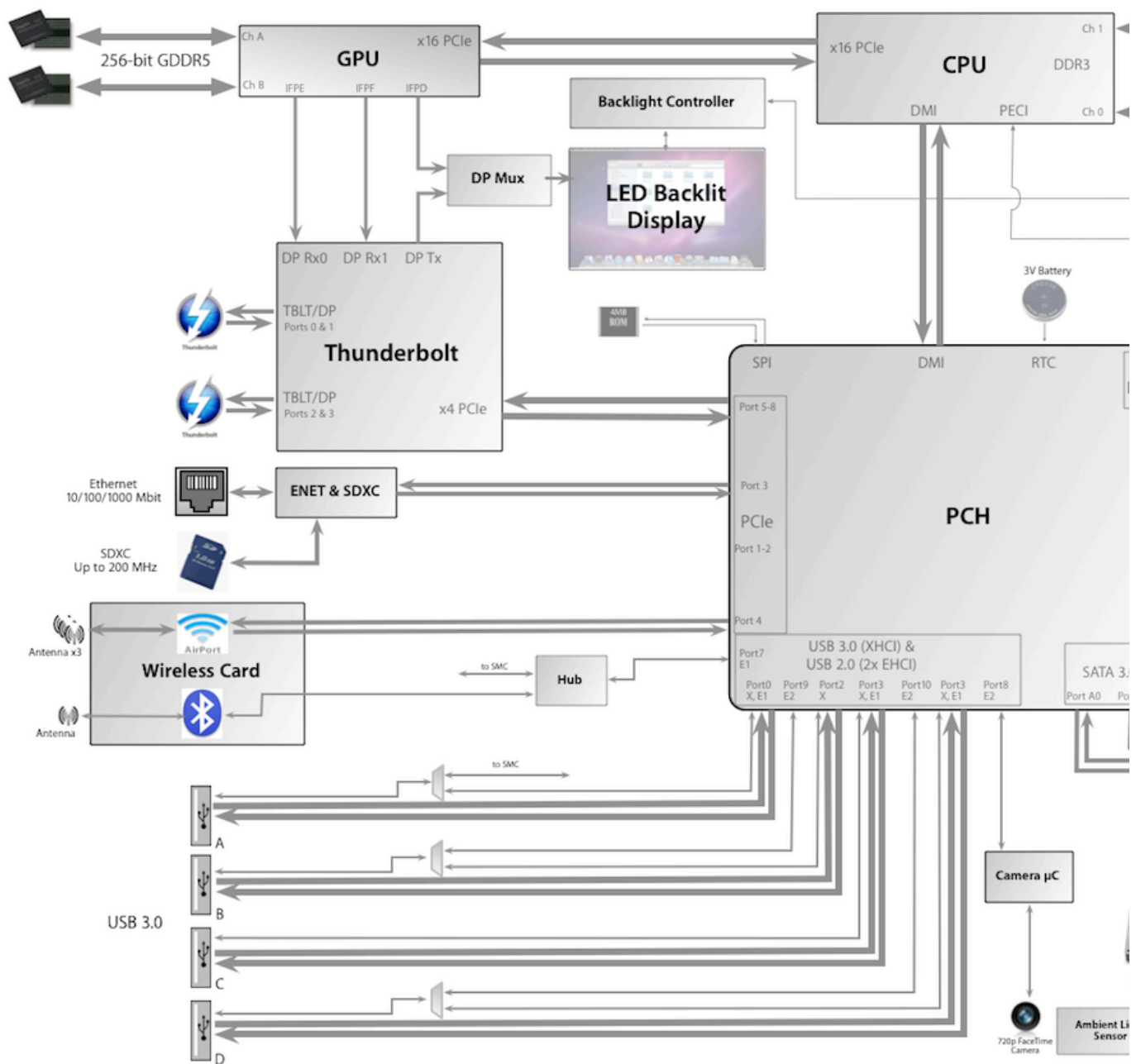
## iMac (Retina 5K, 27-inch, Late 2014)



## iMac (27-inch, Late 2013)



iMac (27-inch, Late 2012)

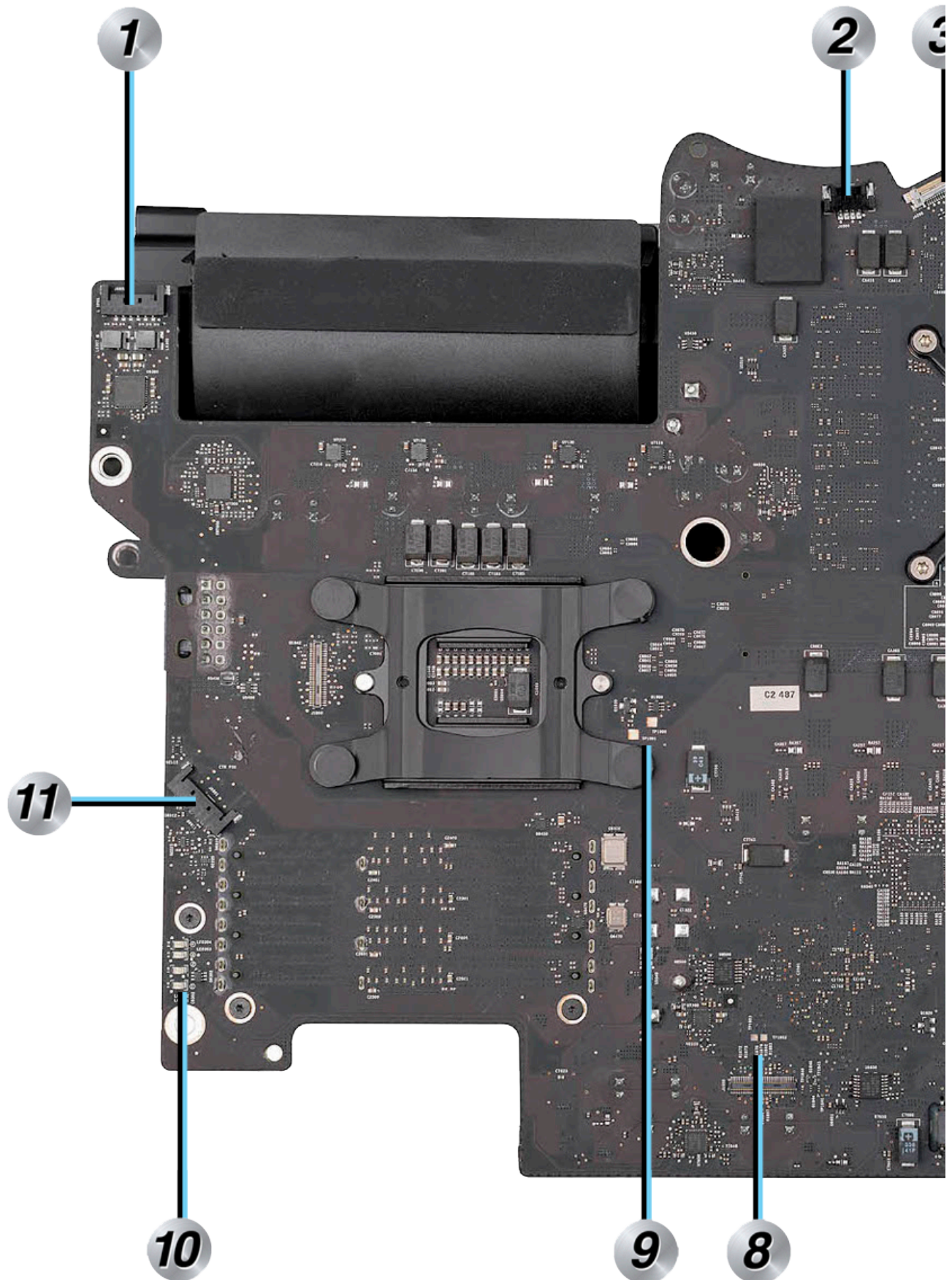


## **iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Functional Overview**

For information on sensors and cable connections, refer to Apple Support article [TP814: Interconnect Diagram](#).

### **Front of Logic Board, iMac (Retina 5K, 27-inch, Late 2014)**

Refer to this diagram for symptoms related to connectors on the front of the logic board.



1 = Left speaker

- no sound from left speaker
- distorted sound from left speaker



## **2 = CPU blower fan**

- system shuts down if fan is disconnected or blocked
- system freezes or kernel panics
- noisy fan perception

## **3 = Camera, camera LED, microphone, and ambient light sensor**

- no camera function
- no LED when camera is on
- no microphone function

## **4 = DisplayPort**

- poor or no video on internal display

## **5 = Display power (backlight control)**

- no LED backlight on internal display

## **6 = Right speaker**

- no sound from right speaker
- distorted sound from right speaker

## **7 = Audio input/output**

- no external optical/analog audio input or output

## **8 = Reset test points**

- short across to reset RTC

## **9 = Backup battery test points**

- use to measure 3V DC backup battery coin voltage

## **10 = Diagnostic LEDs 1-4**

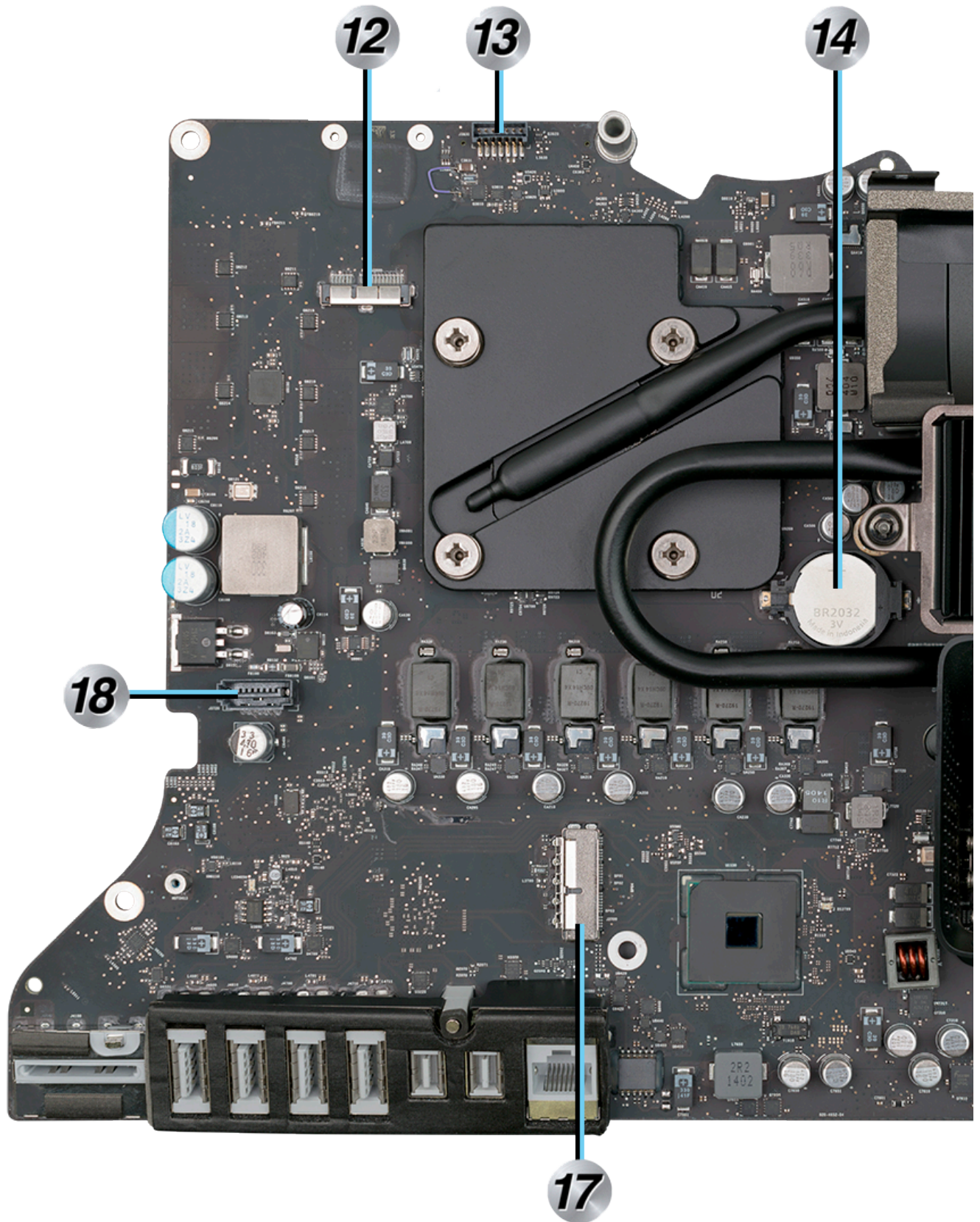
- AC input voltage (trickle power present)
- power supply DC output voltage
- GPU is functioning
- display panel is connected

## **11 = Power-on signal and power supply temperature sensor**

- no power on
- intermittent shutdowns (if cable is pinched or damaged)

## **Back of Logic Board, iMac (Retina 5K, 27-inch, Late 2014)**

Refer to this diagram for symptoms related to the connectors on the back of the logic board.



**12 = Wireless card**

- cannot enable Wi-Fi and/or Bluetooth
- Wi-Fi is not seen in System Info > Network > Wi-Fi
- Bluetooth is not seen in System Info > USB

**13 = SATA hard drive power**

- no SATA hard drive seen on SATA bus
- no boot from hard drive or Fusion drive

**14 = Backup battery**

- no video
- beep tones on startup

**15 = DC power in**

- no power

**16 = Memory**

- no boot
- beep tones on startup
- freezes or kernel panics

**17 = SATA Express flash storage data and power**

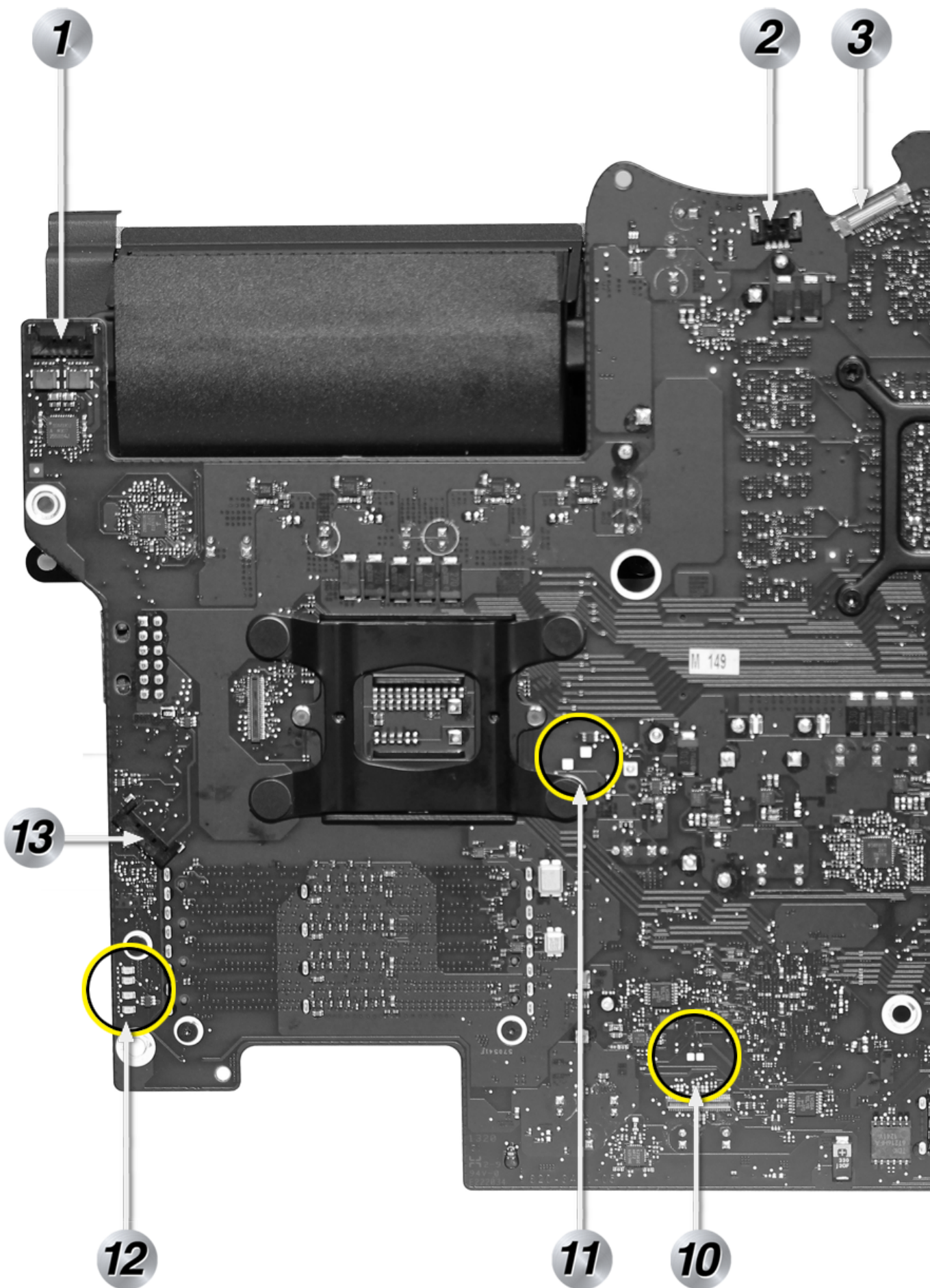
- no flash storage seen on SATA Express bus
- no boot from flash storage or Fusion drive

**18 = SATA hard drive data**

- no SATA hard drive seen on SATA bus
- no boot from hard drive

**Front of Logic Board, iMac (27-inch, Late 2013)**

Refer to this diagram for symptoms related to connectors on the front of the logic board.



1 = Left speaker



- no sound from left speaker
- distorted sound from left speaker

## **2 = CPU blower fan**

- system shuts down if fan disconnected or blocked
- system freezes or kernel panics
- noisy fan perception

## **3 = Camera, camera LED, microphone, and ambient light sensor**

- no camera function
- no LED when camera is on
- no microphone function

## **4 = DisplayPort**

- poor/no video on internal display

## **5 = Bluetooth antenna**

- poor or no Bluetooth signal strength

## **6 = Wi-Fi antennas**

- poor or no Wi-Fi signal strength

## **7 = Display power (backlight control)**

- no LED backlight on internal display

## **8 = Right speaker**

- no sound from right speaker
- distorted sound from right speaker

## **9 = Audio input/output**

- no external optical or analog audio input or output

## **10 = Reset test points**

- short across to reset RTC

## **11= Backup battery test points**

- use to measure 3V DC backup battery coin voltage

## **12 = Diagnostic LEDs 1-4**

- AC input voltage (trickle power present)
- power supply DC output voltage
- GPU is functioning
- display panel is connected

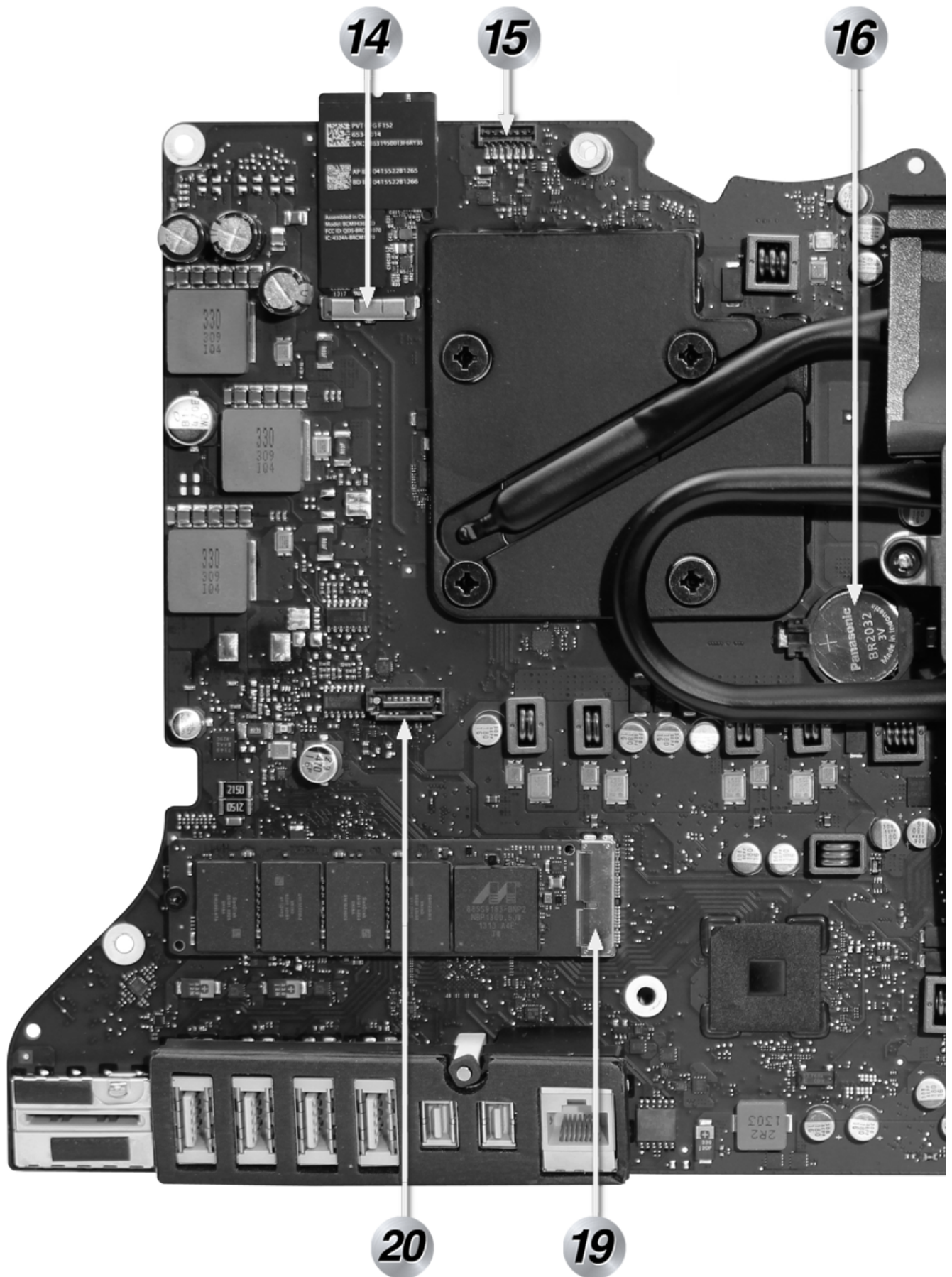
## **13 = Power-on signal + power supply temp sensor**

- no power on
- intermittent shutdowns (if cable is pinched or damaged)

## **Back of Logic Board, iMac (27-inch, Late 2013)**

Refer to this diagram for symptoms related to connectors on the back of the logic board.





**14 = Wireless card**

- cannot enable Wi-Fi and/or Bluetooth
- Wi-Fi not seen in System Info > Network > Wi-Fi
- Bluetooth not seen in System Info > USB

**15 = SATA hard drive power**

- no SATA hard drive seen on SATA bus
- no boot from hard drive or Fusion drive

**16 = Backup battery**

- no video
- beep tones on startup

**17 = DC power in**

- no power

**18 = Memory**

- no boot
- beep tones on startup
- freezes or kernel panics

**19 = SATA Express flash storage data + power**

- no flash storage seen on SATA Express bus
- no boot from flash storage or Fusion drive

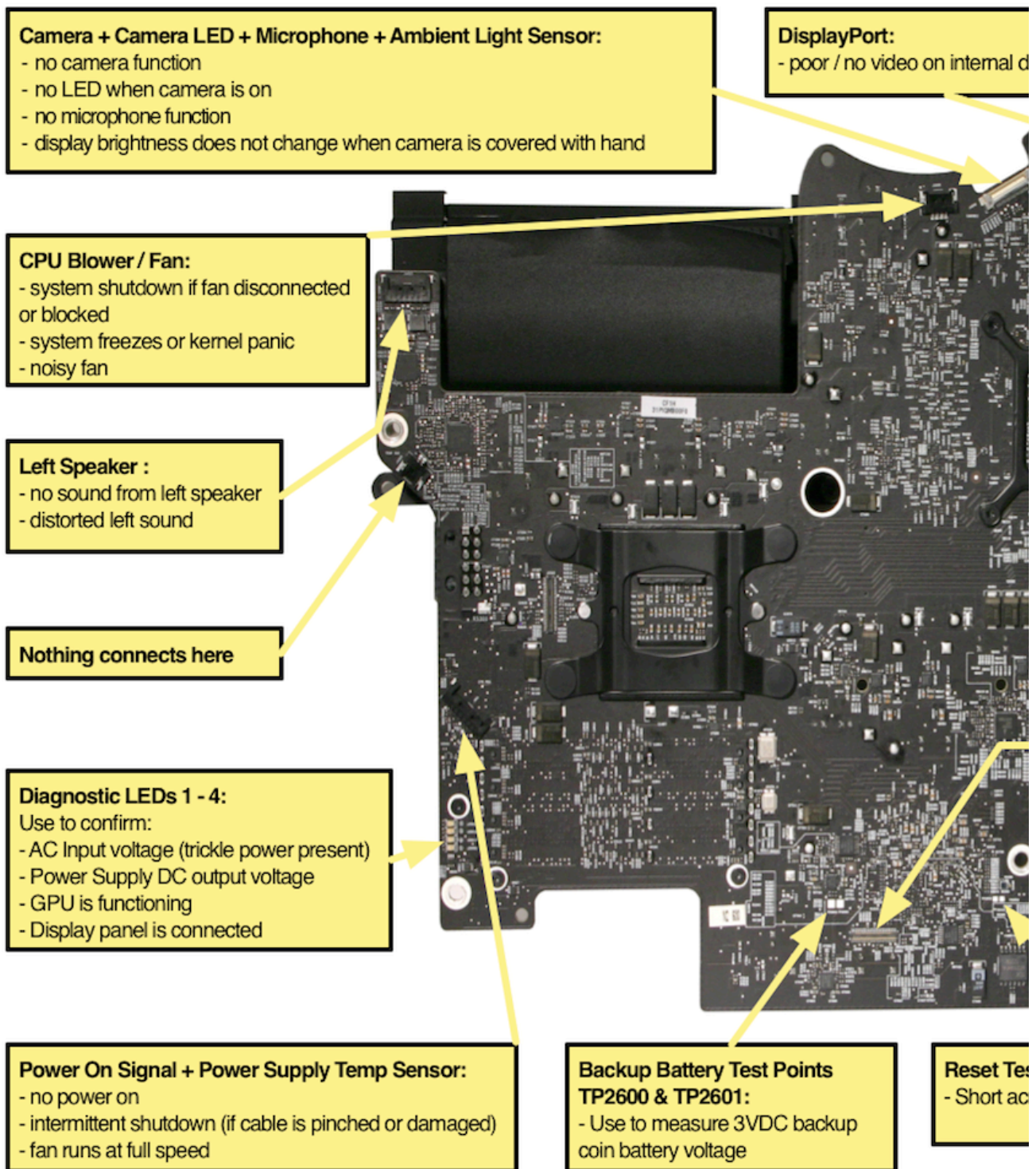
**20 = SATA hard drive data**

- no SATA hard drive seen on SATA bus
- no boot from hard drive

**Front of Logic Board, iMac (27-inch, Late 2012)**

Refer to this diagram for symptoms related to connectors on the front of the logic board.

Side facing display a



## Back of Logic Board

Refer to this diagram for symptoms related to connectors on the back of the logic board.



Side facing rear enclosure

**Wireless Card:**

- cannot enable Wi-Fi and/or Bluetooth
- Wireless card not seen in System Info

**Backup Battery:**

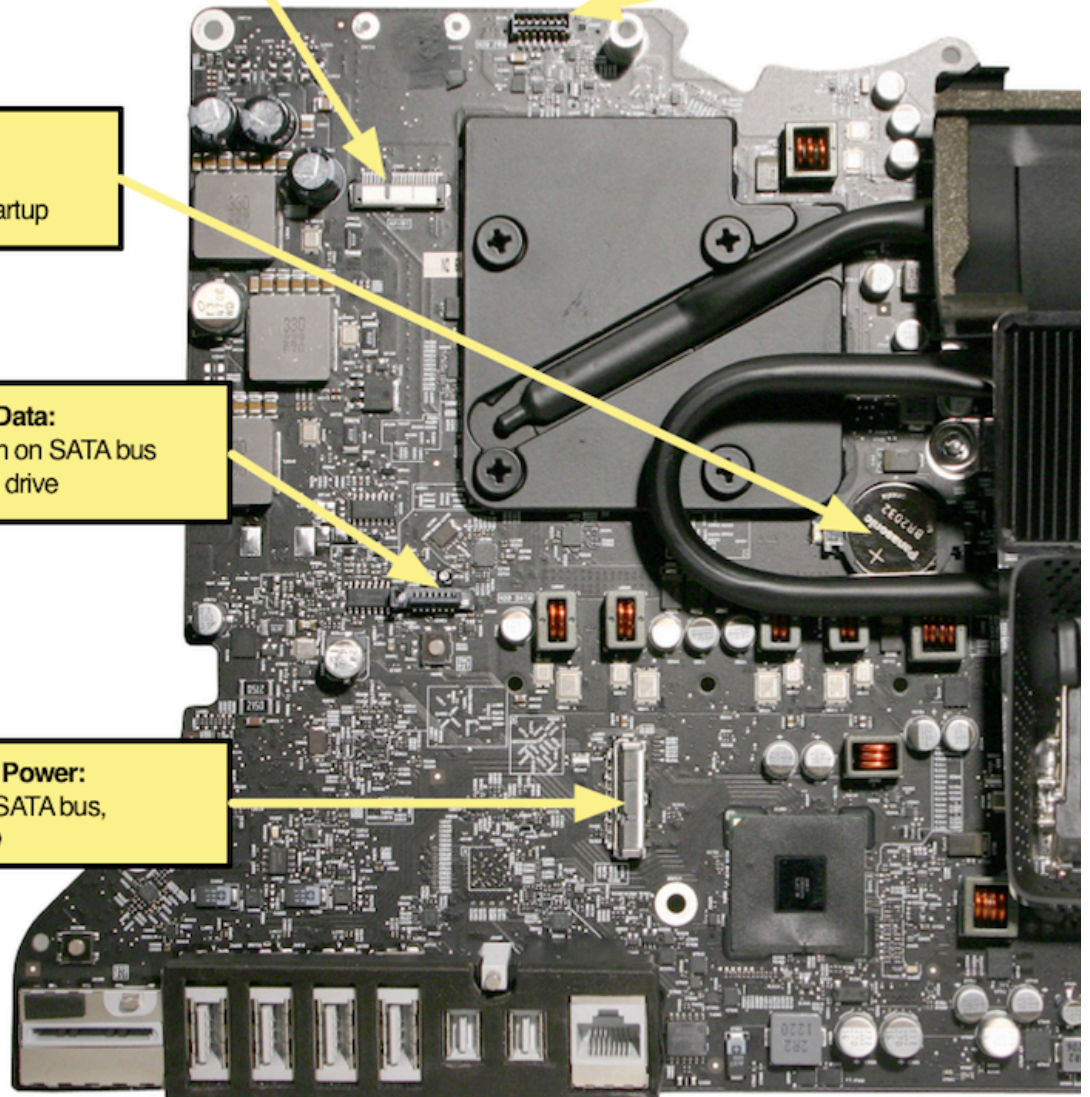
- no video
- beep tones on startup

**SATA Hard Drive Data:**

- no hard drive seen on SATA bus
- no boot from hard drive

**SATA SSD Data + Power:**

- no SSD seen on SATA bus,
- no boot from SSD



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Bluetooth Device Connection Issues

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, logic board, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD) / flash storage card, stand


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Bluetooth can be enabled, but computer will not pair with known-good Bluetooth keyboard, mouse, or trackpad.</li><li>Paired Bluetooth devices intermittently lose their connections.</li><li>Bluetooth data transfer times out or is too slow.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>In System Preferences, make sure Bluetooth is on and set to Discoverable.</li><li>Attempt to pair the computer with a known-good Bluetooth keyboard, mouse, or trackpad.</li><li>Reset the Bluetooth device or delete pairing (if applicable).</li><li>Verify integrity of the user's Bluetooth device with a known-good computer, using Apple Support article <a href="#">TS3048: Troubleshooting wireless mouse and keyboard issues</a>.</li><li>Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>Check for and apply latest software and firmware updates.</li><li>If Bluetooth pairs normally at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. See Apple Support article <a href="#">HT1365: Wi-Fi and Bluetooth: Potential sources of interference</a>.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive



	Check	Result	Action	Code	Commodity
1.	Check Mac Resource Inspector (MRI) test results or System Information > Hardware > USB Device Tree to verify that wireless card is recognized.  Does System Information or MRI detect Bluetooth hardware?	Yes	Go to step 2.		
		No	Go to "Wireless Card Not Recognized" troubleshooting flow.		
2.	Open System Preferences > Bluetooth. Remove all paired devices. Pair computer with a known-good Bluetooth device. Run latest version of Bluetooth Service Diagnostic (BSD) while actively paired with known-good device.  Does computer pass BSD tests?	Yes	Computer appears to be performing to specification when paired with a known-good Bluetooth device. The user's Bluetooth device may be the issue. Go to "I/O Devices: Troubleshooting External Bluetooth Peripherals" troubleshooting flow.		
		No	Go to step 3.		
3.	Start up from known-good, up-to-date, bootable OS X volume. Try to connect to a known-good Bluetooth device. Compare Bluetooth performance and reliability to a known-good computer of similar type and Bluetooth specification.  Is Bluetooth performance comparable between user's computer and known-good computer?	Yes	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> , and restore the computer to the correct build of OS X. Verify resolution.		
		No	Go to step 4.		
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.  Remove LCD panel with glass.  Locate the A3 Bluetooth antenna (second from left), and inspect antenna's cable and connector for any damage.  <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>  Are antenna cable and connector in good condition?	Yes	Go to step 5.		
		No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC
5.	Locate A3 Bluetooth antenna port on wireless card (second from left), and verify it is not damaged, loosened, or unsoldered. Reseat antenna connector to wireless card. Make sure connection is secure and correctly aligned.  Is A3 antenna connector port in good condition and securely seated?	Yes	Go to step 6.		
		No	Replace wireless card. Verify issue resolved.	N17	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
6.	Reseat A3 antenna cable connection to wireless card (second from left). Connect an external display and try to pair with a known-good Bluetooth device.	Yes	Issue resolved by reseating Bluetooth antenna. Verify resolution.		
	Did computer pair successfully with known-good Bluetooth device?	No	Go to step 7.		
7.	The Bluetooth antenna is located on upper edge of the enclosure and is available as a standalone part.	Yes	Go to step 8.		
	Do you have immediate access to a known-good Bluetooth antenna?	No	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC
8.	Substitute known-good (upper) Bluetooth antenna. Connect an external display and try to pair with a known-good Bluetooth device.	Yes	Replace Bluetooth antenna. Verify issue resolved.	X03	OTHER ELECTRIC
	Did computer pair successfully with known-good Bluetooth device?	No	Replace user's wireless card. Reinstall user's Bluetooth antenna. Verify issue resolved.	N15	WIRELESS DEVICE
9.	<ul style="list-style-type: none"> <li>Run latest version of Bluetooth Service Diagnostic to verify Bluetooth functionality.</li> <li>Pair with a known-good Bluetooth device and verify that connection is sustained for several minutes.</li> </ul> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Ethernet Issues

## Unlikely causes:


AirPort/Bluetooth antenna(s), battery, camera, camera/microphone/ALS cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, wireless card.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• No Ethernet device present.</li><li>• Unable to access Ethernet network resources.</li><li>• Ethernet device shows no connection.</li><li>• Ethernet device unable to get an IP address.</li><li>• Slow Ethernet network performance.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Verify network setup by accessing it directly via a known-good computer's Ethernet port.</li><li>2. Launch System Information. Verify that computer's Ethernet port appears in the Network devices tree.</li><li>3. Test with known-good network hardware and an Ethernet cable (Cat-5 or better is recommended for 100+ Mbps connections).</li><li>4. Using known-good network hardware and cable, start up from a known-good, up-to-date OS X volume. Go to Network Utility &gt; Info and verify that Link Status is "Active."</li><li>5. Check network settings. If a known-good DHCP server is available, set System Preferences &gt; Network &gt; Ethernet to Using DHCP. Verify IP address. (If it begins with 169.x.x.x, system was unable to get a valid IP address.) See Apple Support article <a href="#">TA21114: Mac OS X: How To Force a DHCP Lease Renewal</a>.</li><li>6. When started up from user's OS, revert to default network settings by creating a new location in System Preferences &gt; Network.</li><li>7. Check for and apply latest software and firmware updates.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect Ethernet port for dust, debris, damage, or bent pins. Use compressed air to remove debris. Plug in a known-good Ethernet cable and make sure all pins make physical contact with connector.	Yes	Go to step 2.		
	Are any Ethernet port pins damaged or making insufficient contact with known-good RJ-45 connector?	No	Go to step 4.		
2.	Inspect logic board, Ethernet port, and enclosure for dents, scratches, or other indications of impact or abuse.	Yes	Go to step 3.		
	Does accidental damage appear to be cause of issue?	No	Replace logic board. Verify issue resolved.	M10	MLB
3.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.	Yes	Replace logic board. Verify issue resolved.	M10	MLB
	Does user want to proceed with out-of-warranty repair?	No	Issue resolved. Return computer to user using correct positioning.		
4.	Ensure that user's computer is connected to the Internet using a known-good Ethernet cable, and that WiFi is turned off so that all network traffic goes through built-in Ethernet.	Yes	Reinstall correct build of OS X on user's computer. Issue resolved by reinstalling correct build of OS X on user's computer.		
	Start up computer using OS X Recovery or an up-to-date, bootable OS X volume. Hold down Command-R during startup to restart from recovery partition. See Apple Support articles <a href="#">HT4718: OS X: About OS X Recovery</a> and <a href="#">HT1159: Mac OS X versions (builds) for computers</a> .  Open Safari browser and attempt to access a known-good external web page such as <a href="http://www.apple.com">http://www.apple.com</a> to verify Ethernet connectivity. Look for the web page to load, or for a timeout indicating page did not load.  Are Ethernet network resources accessible starting from recovery partition or a known-good OS?	No	Go to step 5.		
5.	Restart user's computer to OS on its built-in OS X boot volume.	Yes	Go to step 6.		
	In System Preferences > Network > Ethernet, verify that link status is Connected (green dot) and that a valid IP address is listed. Connect computer to an Ethernet network with a known-good DHCP server. Make sure static DHCP maps or filtering are not preventing address allocation.  <b>Note:</b> DHCP allocation may not be instantaneous, depending on network. Retest.  Is Ethernet link status active?	No	Replace logic board. Verify issue resolved.	M10	MLB

	Check	Result	Action	Code	Commodity
6.	<p>Go to System Preferences &gt; Network &gt; Ethernet and obtain router IP address. Use Network Utility to ping router IP address. Use a simple hub/switch environment.</p> <p>Is Network Utility able to ping router IP address?</p>	Yes	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to Apple Support article <a href="#">TS1317: Mac OS X: Troubleshooting a cable modem, DSL, or LAN Internet connection</a> .		
		No	Go to step 7.		
7.	<p>Perform network testing from previous step, using same cable and network, but with a known-good computer.</p> <p>Is network performance of user's computer inferior to known-good computer?</p>	Yes	Replace logic board. Verify issue resolved.	M10	MLB
		No	No performance or connectivity issues detected. No repair necessary. The problem may be the network environment. Refer user to Apple Support article <a href="#">TS1317: Mac OS X: Troubleshooting a cable modem, DSL, or LAN Internet connection</a> .		
8.	<ol style="list-style-type: none"> <li>1. Connect Ethernet cable to a known-good network with a DHCP server.</li> <li>2. In System Preferences &gt; Network &gt; Ethernet, verify link status is Connected (green dot).</li> <li>3. Configure TCP/IP settings to Using DHCP and check that a valid IP address is obtained from server (not a self-assigned one starting with 169.x.x.x).</li> <li>4. Launch web browser and verify that you can access websites and download files.</li> </ol> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	



# Thunderbolt Ethernet Adapter Connectivity Issues

## Unlikely causes:

There are no unlikely causes for this issue.


## Quick Check



Symptoms	Quick Check
<ul style="list-style-type: none"><li>No Ethernet present in Network preferences.</li><li>Unable to access Ethernet network resources.</li><li>Ethernet shows no active link or connection.</li><li>Ethernet intermittently drops connection.</li><li>Ethernet unable to get an IP address.</li><li>Slow Ethernet network performance.</li></ul> <p><b>Note:</b> These symptoms address issues with the Thunderbolt Ethernet Adapter, not the computer's Thunderbolt port. If you suspect an issue with the computer after attempting Quick Check steps that follow, please back up and click on the 'Troubleshoot another issue' button to select a functional area and issue that addresses issues with computer's Thunderbolt port instead.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options. Refer to Apple Support article <a href="#">OP14: SERVICE: Determining and quoting accidental damage for Mac portables</a>.</p>	<ol style="list-style-type: none"><li>Verify network setup by accessing it directly via an Ethernet port on a known-good computer.</li><li>Check System Information. Verify Ethernet port presence in System Information &gt; Hardware &gt; Ethernet Cards. Verify Ethernet adapter presence in System Information &gt; Hardware &gt; Thunderbolt.</li><li>Try known-good Ethernet adapter, network hardware and Ethernet cable and user's computer.</li></ol> <p><b>Note:</b> Cat 5 or better is recommended for 100+ Mbps connections.</p> <ol style="list-style-type: none"><li>Using a known-good Ethernet adapter, network hardware and cable, start up from a known-good OS X volume or Lion Recovery Partition. Go to Network Utility &gt; Info and verify Link Status is "Active."</li><li>Check network settings. If a known-good DHCP server is available, set System Preferences &gt; Network &gt; Ethernet to "Using DHCP." Verify IP address.</li></ol> <p><b>Note:</b> If the IP address begins with 169.x.x.x, the system was unable to get a valid IP address. See Apple Support article <a href="#">TA21114: Mac OS X: How To Force a DHCP Lease Renewal</a>.</p> <ol style="list-style-type: none"><li>Start up from user's OS. Revert to default network settings by creating a new location in System Preferences &gt; Network.</li><li>Check for and apply the latest software and firmware updates.</li></ol>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect both connectors, cable, and body of Thunderbolt Ethernet Adapter. Check for dust, debris, damage, bent pins, or other indications of accidental damage. Use compressed air to remove debris.	Yes	Go to step 2.		
		No	Go to step 3.		
	Did you find any damaged components?				
2.	Using Apple Support article <a href="#">OP14: SERVICE: Determining and quoting accidental damage for Mac portables</a> as a guide, inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare.	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X26	EXTERNAL CABLE
	If applicable, discuss out-of-warranty repair options. Refer to Apple Support article <a href="#">OP18: SERVICE: Accidental Damage Repair Pricing for Mail-In Portables and Displays</a> for pricing.	No	Issue resolved. Return computer to user using correct positioning.		
	Does user want to proceed with out-of-warranty repair?				

	Check	Result	Action	Code	Commodity
3.	<p>Connect user's Thunderbolt Ethernet Adapter to an available Thunderbolt port on user's computer. Start up computer completely and launch System Information.</p> <p>Verify Ethernet port presence in System Information &gt; Hardware &gt; Ethernet Cards.</p> <p>Verify Ethernet adapter presence in System Information &gt; Hardware &gt; Thunderbolt.</p> <p>Does user's Thunderbolt Ethernet Adapter appear in both areas of System Information?</p>	Yes	Go to step 6.		
		No	Go to step 4.		
4.	<p>To troubleshoot this issue completely, a known-good Thunderbolt Ethernet Adapter is required.</p> <p>Do you have immediate access to a known-good Thunderbolt Ethernet Adapter?</p>	Yes	Go to step 5.		
		No	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
5.	<p>Connect a known-good Thunderbolt Ethernet Adapter to user's computer to verify adapter presence.</p> <p>Verify Ethernet port presence in System Information &gt; Hardware &gt; Ethernet Cards.</p> <p>Verify Ethernet adapter presence in System Information &gt; Hardware &gt; Thunderbolt.</p> <p>Does known-good Thunderbolt Ethernet Adapter now appear in both areas of System Information?</p>	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TSPS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
6.	<p>Connect user's Thunderbolt Ethernet Adapter to an available Thunderbolt port on user's computer.</p> <p>Connect adapter's RJ-45 port to an Ethernet network with a known-good DHCP server using a known-good Cat 5 or better Ethernet cable. Start up computer completely.</p> <p>In System Preferences &gt; Network &gt; Ethernet, verify link status is "Connected" (green dot) and a valid IP address is listed. Make sure static DHCP maps or filtering are not preventing address allocation.</p> <p><b>Note:</b> DHCP allocation may not be instantaneous, depending on the network. Retest.</p> <p>Is Ethernet link status active?</p>	Yes	Go to step 9.		
		No	Go to step 7.		

	Check	Result	Action	Code	Commodity
7.	To troubleshoot this issue completely, a known-good Thunderbolt Ethernet Adapter is required.  Do you have immediate access to a known-good Thunderbolt Ethernet Adapter?	Yes	Go to step 8.		
		No	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
8.	Connect known-good Thunderbolt Ethernet Adapter to an available Thunderbolt port on user's computer. Connect adapter to known-good DHCP server using a Cat 5 or better Ethernet cable.  Start up computer. In System Preferences > Network > Ethernet, verify link status is "Connected" (green dot) and a valid IP address is listed.  Is Ethernet link status now active?	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TSPS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
9.	Check network connection on user's computer with known-good cable and network, and user's Thunderbolt Ethernet Adapter.  Go to System Preferences > Network > Ethernet and obtain Router IP address.  Use Network Utility to ping Router IP address. Use a simple hub/switch environment.  Is Network Utility able to ping Router IP address?	Yes	Go to step 12.		
		No	Go to step 10.		
10.	To troubleshoot this issue completely, a known-good Thunderbolt Ethernet Adapter is required.  Do you have immediate access to a known-good Thunderbolt Ethernet Adapter?	Yes	Go to step 11.		
		No	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
11.	<p>Check network connection on user's computer with known-good Thunderbolt Ethernet Adapter, cable and network.</p> <p>Go to System Preferences &gt; Network &gt; Ethernet and obtain Router IP address. Use Network Utility to ping Router IP address. Use a simple hub/switch environment.</p> <p>Is Network Utility now able to ping Router IP address?</p>	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TSPS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
12.	<p>Continue to use Network Utility to ping Router IP address. Use a simple hub/switch environment. Verify connection does not randomly disconnect (seen as packet loss during pings).</p> <p>In System Preferences &gt; Network &gt; Ethernet, verify link status is consistently active throughout testing.</p> <p>Is Network Utility able to ping Router IP address consistently, with no packet loss?</p>	Yes	Go to step 15.		
		No	Go to step 13.		
13.	<p>To troubleshoot this issue completely, a known-good Thunderbolt Ethernet Adapter is required.</p> <p>Do you have immediate access to a known-good Thunderbolt Ethernet Adapter?</p>	Yes	Go to step 14.		
		No	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
14.	<p>Check network performance on user's computer with known-good Thunderbolt Ethernet Adapter, cable and network.</p> <p>Continue to use Network Utility to ping Router IP address. Verify connection does not randomly disconnect (seen as packet loss during pings).</p> <p>In System Preferences &gt; Network &gt; Ethernet, verify link status is consistently active throughout testing.</p> <p>Is Network Utility able to ping Router IP address consistently, with no packet loss?</p>	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TSPS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
15.	<p>Connect user's Ethernet Adapter and cable to a known-good computer on same network. Continue to use Network Utility to ping Router IP address.</p> <p>In System Preferences &gt; Network &gt; Ethernet, verify link status is consistently active throughout testing.</p> <p>Is network performance of user's adapter inferior when used with a known-good computer?</p>	Yes	Replace Thunderbolt Ethernet Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	<p>No performance or connectivity issues detected. No repair necessary. The problem may be network environment.</p> <p>Refer user to Apple Support article <a href="#">TS1317: Mac OS X: Troubleshooting a cable modem, DSL, or LAN Internet connection.</a></p>		
16.	<ol style="list-style-type: none"> <li>1. Connect Ethernet cable to a known-good network with a DHCP server.</li> <li>2. In System Preferences &gt; Network &gt; Ethernet, verify the link status is "Connected" (green dot).</li> <li>3. Configure TCP/IP settings to "Using DHCP" and check that a valid IP address is obtained from server (not a self-assigned one starting with 169.x.x.x).</li> <li>4. Launch web browser and verify access to websites and download files.</li> </ol> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TSPS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Wi-Fi Connection Issues

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, DisplayPort cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, logic board, memory, power supply, right speaker, stand


## Quick Check

Symptoms	Quick Check
<p>Wi-Fi interface is present and can be enabled but the following symptoms occur during use:</p> <ul style="list-style-type: none"><li>• Unable to find or connect to wireless networks</li><li>• Slow or stalled data transfers</li><li>• Intermittent connection dropouts</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p><b>On user's computer:</b></p> <ol style="list-style-type: none"><li>1. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>2. Using alternate Ethernet network interface, connect to Internet, then check for and apply latest software and firmware updates.</li><li>3. If computer is running OS X Lion, refer to the steps in Apple support article <a href="#">TS3925: OS X Lion: Unable to download OS X Lion wirelessly from Mac App Store - "Your device or computer could not be verified"</a> to delete the file "networkinterfaces.plist" from the SystemConfiguration folder. Restart the user's computer into the user's OS and create a new network location in System Preferences. Attempt to connect to the Internet again via Wi-Fi to verify if this resolves the issue.</li><li>4. Start up computer using recovery partition or an up-to-date, bootable OS X volume, and attempt to connect to a wireless network.</li><li>5. In System Preferences &gt; Sharing select Internet Sharing. Configure a known-good computer to "Share your connection from" &gt; Ethernet and "To computers using" &gt; Wi-Fi. Try to connect user's computer to the newly created wireless network.</li><li>6. Using a known-good OS &amp; base station, compare Wi-Fi throughput in Activity Monitor &gt; Network to that of a similar computer.</li><li>7. Refer to Apple Support article <a href="#">HT5606: About Wireless Diagnostics</a> to familiarize yourself with OS X 10.8.4 wireless diagnostic utilities.</li><li>8. Reset PRAM by holding down the Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</li><li>9. Reset the SMC using the procedure for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol> <p><b>If the issue cannot be reproduced onsite, prompt the user to check their AirPort base station for the following:</b></p> <ol style="list-style-type: none"><li>1. Check for base station firmware updates.</li><li>2. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones. See Apple Support article <a href="#">HT1365: Wi-Fi and Bluetooth: Potential sources of wireless interference</a>.</li><li>3. Make sure base station is not using MAC address filtering or has not created a hidden network.</li><li>4. Make sure base station is not set to low-power transmission mode.</li><li>5. Make sure base station is not using an unsupported connection and encryption protocol.</li><li>6. Check for Wi-Fi channel overlap (a nearby base station using an adjacent channel).</li><li>7. Connect to a known-good test network.</li></ol>




	<p>8. Test in a different environment.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>
--	--

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) or check System Information to see whether the wireless card is recognized.	Yes	Go to step 2.		
	System Information: <ul style="list-style-type: none"> <li>• Network &gt; Wi-Fi &gt; Interfaces</li> </ul> Is Wi-Fi service detected in MRI or System Information?	No	Go to “Wireless Card Not Recognized” troubleshooting flow.		
2.	Start up computer using an up-to-date, bootable OS X volume. Attempt to reproduce the Wi-Fi performance or connection issue.	Yes	Go to step 3.		
	Does issue persist with known-good OS?	No	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and install correct version of OS X. Check for and apply latest software and firmware updates. Verify issue resolved.		
3.	Turn off Bluetooth to eliminate potential interference. Check for other interference such as microwave ovens or cordless phones. See Apple Support article <a href="#">HT1365: Wi-Fi and Bluetooth: Potential sources of wireless interference</a> . Change base station channel.	Yes	Go to step 4.		
	Does the issue persist?	No	Issue caused by interference. Remove sources of interference, or use a different Wi-Fi channel or mode (2.4 or 5 GHz). Verify issue resolved.		

	Check	Result	Action	Code	Commodity
4.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove LCD panel with glass.</p> <p>Locate the three Wi-Fi antennas and inspect each antenna's cable and connector for any damage.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Are Wi-Fi antenna cables and connectors in good condition?</p>	Yes	Go to step 6.		
		No	Go to step 5.		
5.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03	OTHER ELECTRIC
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar. Choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
6.	<p>Locate Wi-Fi antenna connector ports on wireless card and verify that they are not damaged, loosened, or unsoldered. Reseat antenna connectors to wireless card. Make sure connections are secure and correctly aligned.</p> <p>Are Wi-Fi antenna connector ports in good condition and securely seated?</p>	Yes	Go to step 7.		
		No	Replace wireless card. Verify issue resolved.	N17	WIRELESS DEVICE

	Check	Result	Action	Code	Commodity
7.	<p>To verify Wi-Fi performance and reliability, start up computer using an up-to-date, bootable OS X, 10.8.4 or higher volume for access to Wireless Diagnostics application. See Apple Support article <a href="#">HT5606: About Wireless Diagnostics</a> to familiarize yourself with wireless diagnostic utilities.</p> <p>Connect to a known-good wireless network and open Wireless Diagnostics &gt; Window &gt; Utilities. Review Utilities &gt; Performance - Quality to evaluate signal quality of wireless connection. Verify signal is good or excellent and transmission rate (Tx Rate) is comparable to another known-good computer of similar type and Wi-Fi specification. Where available switch between 2.4GHz and 5 GHz networks to verify signal quality is comparable to a known good computer. Using a network with a high transmission rate, download a large file from a known-good website or file server. Compare network performance to another known-good computer of similar type and Wi-Fi specification. Verify throughput using Activity Monitor &gt; Network.</p> <p>Are performance and throughput comparable between user's computer and a known-good computer?</p>	Yes	Wi-Fi performance is within specification. Verify issue resolved.		
		No	Go to step 8.		
8.	<p>To completely troubleshoot this issue, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• Wireless card</li> <li>• Standalone Wi-Fi antennas (if available)</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 9.		
		No	Replace wireless card. Verify issue resolved.	N14	WIRELESS DEVICE
9.	<p>Substitute a known-good wireless card and retest, comparing performance and throughput of user's computer with known-good computer.</p> <p>Are performance and throughput comparable between computers?</p>	Yes	Replace wireless card. Verify issue resolved.	N14	WIRELESS DEVICE
		No	Go to step 10.		

	Check	Result	Action	Code	Commodity
10.	<p>Substitute known-good Wi-Fi antenna. Connect external display and retest, comparing performance and throughput of user's computer with known-good computer. Repeat with other antennas.</p> <p>Are performance and throughput comparable between computers?</p>	Yes	Go to step 11.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click Help button in GSX toolbar. Choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
11.	<p>Verify whether affected Wi-Fi antenna is available separately as a service part.</p> <p>Is Wi-Fi antenna available as service part?</p>	Yes	Replace affected Wi-Fi antenna. Verify issue resolved.	X03	OTHER ELECTRIC
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>The antenna is part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar. Choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
12.	<ul style="list-style-type: none"> <li>Connect to a known-good wireless network and retest data throughput, checking for adequate transfer speeds.</li> <li>Verify that wireless connection is sustained for several minutes.</li> </ul> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click Help button in GSX toolbar. Choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Wireless Card Not Recognized

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD), stand, Wi-Fi/Bluetooth antenna(s)


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> <li>• Wi-Fi cannot be enabled</li> <li>• Wi-Fi is not detected or available in System Information</li> <li>• Bluetooth cannot be enabled</li> <li>• Bluetooth is not detected or available in System Information</li> <li>• Wi-Fi and/or Bluetooth intermittently becomes disabled</li> </ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> <li>1. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li> <li>2. Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear startup sound for the second time.</li> <li>3. Start up from recovery partition or an up-to-date, bootable OS X volume, and check for the following: <ul style="list-style-type: none"> <li>◦ Wi-Fi network interface presence in System Information and System Preferences &gt; Network.</li> <li>◦ Bluetooth network interface presence in System Information and System Preferences &gt; Bluetooth.</li> </ul> </li> <li>4. Using Ethernet network interface, connect to Internet, then check for and apply latest software and firmware updates.</li> <li>5. Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li> </ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) to see whether wireless card is recognized.	Yes	Go to step 2.		
	Are both Wi-Fi and Bluetooth services detected in MRI?	No	Go to step 4.		

	Check	Result	Action	Code	Commodity
2.	Check MRI to see whether it detects local Wi-Fi network(s).	Yes	Go to “Wi-Fi Connection Issues” troubleshooting flow.		
	Does MRI only fail the Wi-Fi Scan test?	No	Go to step 3.		
3.	Determine whether the wireless issue is related to Bluetooth or Wi-Fi functionality.	Bluetooth	Go to “Bluetooth Device Connection Issues” troubleshooting flow.		
	Is issue related to Bluetooth or Wi-Fi functionality?	Wi-Fi	Go to “Wi-Fi Connection Issues” troubleshooting flow.		
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Issue resolved by reseating wireless card. Verify issue resolved.		
	Remove LCD panel with glass.  Reseat Wireless Card connection to logic board. Connect an external display, and run MRI or check System Information for Wireless Card presence.  <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>  Are both Wi-Fi and Bluetooth services detected in MRI or System Information?	No	Go to step 5.		
5.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 6.		
	Do you have immediate access to a known-good wireless card?	No	Replace wireless card. Verify issue resolved.	N18	WIRELESS DEVICE
6.	Substitute a known-good wireless card. Connect an external display and run MRI or check System Information for wireless card presence.	Yes	Replace wireless card. Verify issue resolved.	N18	WIRELESS DEVICE
	Are both Wi-Fi and Bluetooth services detected in MRI or System Information?	No	Go to step 7.		
7.	Determine whether issue is related to Bluetooth or Wi-Fi functionality.	Bluetooth	Go to “Bluetooth Device Connection Issues” troubleshooting flow.		
	Is issue related to Bluetooth or Wi-Fi functionality?	Wi-Fi	Replace logic board. Reinstall user's wireless card. Verify issue resolved.	M35	MLB

	Check	Result	Action	Code	Commodity
8.	<ul style="list-style-type: none"> <li>• Verify that Wi-Fi network service appears in System Information and can be enabled in System Preferences &gt; Network.</li> <li>• Verify that Bluetooth network interface appears in System Information and can be enabled in System Preferences &gt; Bluetooth.</li> <li>• Connect to a known-good wireless network, and retest data throughput, checking for adequate transfer speeds.</li> <li>• Verify that wireless connection is sustained for several minutes.</li> <li>• Pair with a known-good Bluetooth peripheral. Verify that connection remains functional for several minutes.</li> </ul>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	N99	
	Is issue resolved?				

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Backlight Issue / No Backlight

## Unlikely causes:

AirPort/Bluetooth card, AirPort antenna(s), battery, camera, camera/microphone/ALS cable, CPU fan, hard disk drive (HDD), HDD data cable, HDD power cable, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD) / flash storage card, stand

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Display not illuminated.</li><li>• Flickering, unstable, or non-uniform background lighting.</li><li>• Poor backlight at some or all settings.</li><li>• Computer exhibits power, Power-On Self-Test (POST) chime, and fan movement.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check for and apply the latest software and firmware updates.</li><li>2. Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and verify that the correct version and build of OS X is installed.</li><li>3. Cover ambient light sensor to mimic a dark room, and adjust brightness to maximum setting using F2 key on wired keyboard.</li><li>4. Reset PRAM by holding down Command-Option-P-R keys while rebooting until you hear the startup sound for the second time.</li><li>5. Reset the SMC using the procedure for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>6. Put the computer to sleep by pressing Control-Shift-Eject. Wake it by pressing any key.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect a compatible external display. Check to see whether the external display mirrors the backlight issue or shows any video at all.	Yes	Go to step 2.		
	Does the external display show a video signal of any kind?	No	Go to "Power But Blank/No Video" troubleshooting flow.		

	Check	Result	Action	Code	Commodity
2.	Check Mac Resource Inspector (MRI) results to verify that the LCD is detected. You can use Gateway Manager to access log files on the Apple Service Toolkit (AST) server if there is no video image. Consult the AST Reference Guide for more information on using Gateway Manager. If MRI is not available, use System Information to verify that Color LCD appears in the Display device tree.  Does MRI or System Information detect the LCD?	Yes	Go to step 3.		
		No	Go to "Power But Blank/No Video" troubleshooting flow.		
3.	Shine bright (low-heat) flashlight onto front of LCD. With computer powered on, verify whether a faint image is visible.  Does display show a video signal despite not being backlit?	Yes	Go to step 4.		
		No	Go to "Power But Blank/No Video" troubleshooting flow.		
4.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Inspect display power cable and its connectors between logic board and LCD panel with glass.  Is the cable damaged?	Yes	Replace the LCD panel with glass, which includes the display power cable. Verify issue resolved.	L09	LCD
		No	Go to step 5.		
5.	Reseat display power cable between logic board and LCD panel with glass. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer.  <b>CAUTION:</b> Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.  For additional safety information and tips, refer to Apple Support articles: <ul style="list-style-type: none"><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul> Is normal video restored?	Yes	Issue resolved by reseating display power cable. Verify issue resolution.		
		No	Go to step 6.		



	Check	Result	Action	Code	Commodity
6.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 7.		
7.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 8.		
8.	<p>Reseat the DisplayPort cable between LCD panel and logic board.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer when power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.		
		No	Go to step 9.		
9.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an Embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to Apple Support article <a href="#">TP981: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit</a> or <a href="#">TP982: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Testing the Panel Using the Display Extension Cable Kit</a> for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 10.		
		No	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
10.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
		No	Go to step 11.		

	Check	Result	Action	Code	Commodity
11.	To troubleshoot this issue completely, a known-good LCD panel with glass is required.  Do you have immediate access to a known-good LCD panel with glass?	Yes	Go to step 12.		
		No	Replace the LCD panel with glass. Verify issue resolved.	L03	LCD
12.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Substitute a known-good LCD panel with glass.  Is normal video restored?	Yes	Replace LCD panel with glass. Verify issue resolved.	L03	LCD
		No	Go to step 13.		
13.	To troubleshoot this issue completely, a known-good logic board is required.  Do you have immediate access to a known-good logic board?	Yes	Go to step 14.		
		No	Replace logic board. Verify issue resolved.	M25	MLB
14.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Substitute a known-good logic board.  Is normal video restored?	Yes	Replace logic board. Verify issue resolved.	M25	MLB
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Power But Blank/No Video

## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, CPU fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Power available, but no video visible on display.</li><li>• Fan or hard drive spinning sounds are audible.</li><li>• Caps Lock key LED illuminates when pressed.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Press F2 key to increase screen brightness.</li><li>2. Reset SMC using the procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>3. Reset PRAM by holding down the Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</li><li>4. Disconnect all peripherals.</li><li>5. Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</li><li>6. Use Apple Service Toolkit (AST) to run MRI on this UUT, and examine the result logs from the Diagnostic Gateway to determine OS and build version of the customer's computer. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Reset PRAM by holding down the Command-Option-P-R keys while restarting, until you hear the startup sound for the second time. Start up computer using known-good up-to-date, bootable OS X volume.  Does computer make an audible startup sound?	Yes	Go to step 3.		
		No	Go to step 2.		
2.	While starting up from known-good up-to-date, bootable OS X volume, check whether computer has a memory error (a series of beep tones during startup).  Does computer make error tones during startup?	Yes	Go to “Will Not Start Up” troubleshooting flow.		
		No	Go to step 3.		
3.	Determine whether issue is no backlight or no LCD image:  <ul style="list-style-type: none"> <li>Image with <b>no backlight</b> can be seen by shining a low-heat light source onto the built-in display during or after startup.</li> <li><b>No image</b> can be identified by a blank display with or without backlight or a solid color on the built-in display.</li> </ul> Is the issue no backlight or no image?	No Backlight	Go to “Backlight Issue/No Backlight” troubleshooting flow.		
		No Image	Go to step 4.		
4.	Connect a known-good external display and press power button. Hold down Command-R during startup to restart from the recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display.  Is correct image visible on external display?	Yes	Go to step 5.		
		No	Go to step 10.		

	Check	Result	Action	Code	Commodity
5.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.	Yes	Go to step 10.		
	<p>Use one of the methods below to determine whether the user's computer recognizes its built-in LCD display panel.</p> <p>METHOD 1: Review MRI results or System Information &gt; Graphics/Displays. Look for information indicating internal display presence in results.</p> <p>METHOD 2: Remove LCD display panel with glass.</p> <p>Connect AC power cord to computer and plug into mains. Locate diagnostic LEDs on logic board. Connect a known-good external display and press power button. During startup, computer should communicate with video controller and light diagnostic LED #4 to indicate an active display.</p> <p><b>Note:</b> LED #4 may not light with LCD display panel removed.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p>	No	Go to step 6.		
6.	Is built-in LCD display panel detected?				
	Inspect DisplayPort cable and connectors for damage. Also inspect connectors on LCD display panel and logic board.	Yes	Go to step 7.		
		No	Go to step 8.		
	Did you find any damaged components?				
7.		Yes	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
	<p>Damage to multiple parts requires an escalation to TCS for approval for repair.</p> <p>Is damage limited to DisplayPort cable only?</p>	No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	L99	



	Check	Result	Action	Code	Commodity
8.	<p>To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.</p> <p>Refer to Apple Support article <a href="#">TP981: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit</a> or <a href="#">TP982: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Testing the Panel Using the Display Extension Cable Kit</a> for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	Yes	Go to step 9.		
		No	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
9.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>If any known-good cables are still installed from previous steps, continue using known-good cables to help find faulty module.</p> <p>Does LCD present video with or without backlight?</p>	With Backlight	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
		No Backlight	Replace the LCD display panel with glass. Verify issue resolved.	L03	LCD
10.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding and allow the power supply and logic board to discharge.</p> <p>Remove LCD display panel with glass.</p> <p>Locate diagnostic LEDs on logic board. Connect AC power cord and press power button, diagnostic LEDs #1 and #2 should be on. This indicates power to computer.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Are diagnostic LEDs #1 and #2 on?</p>	Yes	Go to step 11.		
		No	Go to "No Power" troubleshooting flow.		

	Check	Result	Action	Code	Commodity
11.	Disconnect DisplayPort cable from logic board. Connect a known-good external display and press power button. Hold down Command-R during startup to restart from recovery partition. Toggle video mirroring (Command-F1) to view main screen startup screen on external display. Verify that video is correct when viewed on external display.  Is correct image visible on external display?	Yes	Replace LCD display panel with glass. Verify issue resolved.	L03	LCD
		No	Replace logic board. Verify issue resolved.	M03	MLB
12.	Restart the computer and verify that the video is fully functional.  Is the issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> Contact TCS for additional support or a multiple part repair.  Click the Help button in the GSX Toolbar then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	L99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Display Anomalies

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Incorrect or missing colors</li><li>• Non-uniform brightness</li><li>• Distorted/blurred image</li><li>• Pixel anomalies</li><li>• Unstable flickering</li><li>• Vertical/horizontal lines</li><li>• Light leakage around display edges</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: About OS X Recovery</a>.</li><li>2. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>3. Check System Preferences &gt; Displays &gt; Color for possible use of a custom display profile. Ensure profile is set to "iMac".</li><li>4. Check the brightness setting.</li><li>5. Check for and apply latest software and firmware updates, especially those that deal with display or graphic issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following Apple Support articles:<ul style="list-style-type: none"><li>• <a href="#">HT1573: Troubleshooting issues with video on internal or external displays</a></li><li>• <a href="#">HT1599: Installing available updates</a></li></ul></li><li>6. Clean glass panel and check for dust or debris.</li><li>7. Reset PRAM by holding down Command-Option-P-R keys while restarting until you hear startup sound for the second time.</li><li>8. Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Resetting the System Management Controller (SMC)</a>.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Compare an image on user's display with the same image on an equivalent, known-good computer display.	Yes	Go to step 42.		
	Of the seven issues below, verify that "Incorrect or missing colors" best describes the primary symptom:	No	Go to step 2.		
	<ul style="list-style-type: none"> <li>• <b>Incorrect or missing colors</b></li> <li>• Non-uniform brightness</li> <li>• Distorted/blurred image</li> <li>• Pixel anomalies</li> <li>• Unstable flickering</li> <li>• Vertical/horizontal lines</li> <li>• Light leakage around display edges</li> </ul>				
	Is incorrect or missing colors the primary display issue?				
2.	Set desktop pattern in System Preferences > Desktop & Screen Saver > Desktop to Solid Gray Light to verify that issue is non-uniform brightness. Observe display behavior.	Yes	Go to step 38.		
	Of the six issues below, verify that "Non-uniform brightness" best describes the primary symptom:	No	Go to step 3.		
	<ul style="list-style-type: none"> <li>• <b>Non-uniform brightness</b></li> <li>• Distorted/blurred image</li> <li>• Pixel anomalies</li> <li>• Unstable flickering</li> <li>• Vertical/horizontal lines</li> <li>• Light leakage around display edges</li> </ul>				
	Is non-uniform brightness the primary display issue?				
3.	Compare an image on user's display with the same image on an equivalent, known-good computer display.	Yes	Go to step 26.		
	Of the five issues below, verify that "Distorted/blurred image" best describes the primary symptom:	No	Go to step 4.		
	<ul style="list-style-type: none"> <li>• <b>Distorted/blurred image</b></li> <li>• Pixel anomalies</li> <li>• Unstable flickering</li> <li>• Vertical/horizontal lines</li> <li>• Light leakage around display edges</li> </ul>				
	Is a distorted or blurred image the primary display issue?				

	Check	Result	Action	Code	Commodity
4.	Use Apple Service Toolkit Test Pattern Tools (TPT) test to identify any pixel anomalies. Examine display using solid white, red, green, and blue screens to reveal bright and dark subpixel anomalies or foreign material trapped within display.	Yes	Go to step 24.		
	<p>Refer to Apple Support article <a href="#">HT4044: About LCD display pixel anomalies for Apple products released in 2010 and later</a> to determine whether number of anomalies exceeds specification.</p> <p>Of the four issues below, verify that "Pixel anomalies" best describes the primary symptom:</p> <ul style="list-style-type: none"> <li>• <b>Pixel anomalies</b></li> <li>• Unstable flickering</li> <li>• Vertical/horizontal lines</li> <li>• Light leakage around display edges</li> </ul> <p>Are pixel anomalies the primary display issue?</p>	No	Go to step 5.		
5.	Compare an image on user's display with the same image on an equivalent, known-good computer display.	Yes	Go to "Unstable Flickering" troubleshooting flow.		
	<p>Of the three issues below, verify that "Unstable flickering" best describes the primary symptom:</p> <ul style="list-style-type: none"> <li>• <b>Unstable flickering</b></li> <li>• Vertical/horizontal lines</li> <li>• Light leakage around display edges</li> </ul> <p>Is unstable flickering the primary display issue?</p>	No	Go to step 6.		
6.	Compare an image on user's display with the same image on an equivalent, known-good computer display.	Yes	Go to step 11.		
	<p>Of the two issues below, verify that "Vertical/horizontal lines" best describes the primary symptom:</p> <ul style="list-style-type: none"> <li>• <b>Vertical/horizontal lines</b></li> <li>• Light leakage around display edges</li> </ul> <p>Are vertical or horizontal lines the primary display issue?</p>	No	Go to step 7.		
7.	Compare an image on user's display with the same image on an equivalent, known-good computer display.	Yes	Go to step 8.		
	<p>Verify that "Light leakage around display edges" best describes primary symptom.</p> <p>Customers may report that sides of the display appear to glow when they view it in a dimmed room, particularly when viewing dark or black images.</p> <p>Is light leakage around display edges the primary display issue?</p>	No	LCD seems to be within specifications. Do not replace LCD panel with glass. Verify resolution.		



	Check	Result	Action	Code	Commodity
8.	Launch the Test Pattern Tool (TPT) within AST to display the All Black display test pattern.	Yes	Go to step 9.		
	<p>It is very important that you verify this issue using ONLY an all black display test pattern with no other images present such as icons, dock, etc.</p> <p>Adjust display position and brightness to normal settings.</p> <p>Dim lights so you can more clearly see any light leakage around edges of the LCD display.</p> <p>Is any noticeable light leakage present around edges of the display?</p>	No	Explain to user that display is within specifications. Do not replace LCD panel with glass. Verify resolution.		
9.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Carefully disconnect and remove LCD panel with glass.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is reseated to these surfaces.</p> <p>Remove and closely inspect chin strap for any damage, bowing, or bending.</p> <p>Verify that all cushioned pads are securely installed on each end of the chin strap and are not damaged, torn, out of place, or missing. These pads are part of the chin strap.</p> <p>Does chin strap appear damaged, bent, or bowed?</p>	Yes	Replace chin strap. Reinstall user's LCD display with glass. Verify issue resolved.	X13	PIECE PART
		No	Go to step 10.		

	Check	Result	Action	Code	Commodity
10.	Recheck that previous disassembly was performed properly using proper tools and techniques and not by simply pulling display off. Incorrect removal technique can damage or bow chin strap, causing light leakage in lower display area.	Yes	Replace LCD panel with glass. Verify issue resolved.	L28	LCD
	Reinstall chin strap, being very careful to not damage, bow, or otherwise bend chin strap during installation.  Reapply new foam tape gaskets for all four display sides, being very careful to apply the tape smoothly around entire edge.	No	Issue resolved by reseating display and chin strap. Verify issue resolution.		
10.	Reinstall LCD panel with glass, being careful when seating edges of display against foam-backed tape around edges to ensure a smooth, complete seal around entire perimeter.  Connect power cord to computer, wait 5 seconds for SMC to become ready, then press power button to start up computer.  Recheck for light leakage using TPT within AST to display All Black display test pattern.  Is any noticeable light leakage still present around edges of display?				
11.	Connect an external compatible display.	Yes	Go to step 12.		
	Are vertical and/or horizontal lines present on external display?	No	Go to step 17.		
12.	Vertical and/or horizontal lines may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.	Before	Go to step 17.		
	Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	After	Go to step 13.		
13.	To start up into Safe Mode, press power button; then as soon as you hear startup sound, hold down Shift key. Shift key should be held as soon as possible after startup sound, but not before sound. Release Shift key when you see gray Apple icon and the spinning gear.	Yes	Go to step 17.		
	Does issue still occur in Safe Mode?	No	Go to step 14.		
14.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.	Yes	Go to step 15.		
	Are you able to remove RAM modules?	No	Go to step 17.		

	Check	Result	Action	Code	Commodity
15.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of LCD display and logic board to access the memory modules.	Yes	Replace memory module(s).  <b>Note:</b> Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	<b>Note:</b> Be sure to always have at least the minimum amount of memory installed to support computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1 GB module with a known-good 2 GB module to support starting into OS X.  Does issue occur only with specific memory module(s)?	No	Go to step 16.		
16.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on the logic board?	No	Go to step 17.		
17.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 18.		
	Remove LCD panel with glass and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.  Is DisplayPort cable or its connector damaged?	No	Go to step 20.		
18.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 19.		
	Refer to Apple Support article <a href="#">TP981: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit</a> or <a href="#">TP982: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Testing the Panel Using the Display Extension Cable Kit</a> for information about how to use extension cables.  Do you have immediate access to a known-good DisplayPort cable?	No	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
19.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
		No	Go to step 20.		
20.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 21.		
21.	<p>To troubleshoot this issue completely, a known-good LCD panel with glass is required.</p> <p>Do you have immediate access to a known-good LCD panel with glass?</p>	Yes	Go to step 22.		
		No	Go to step 23.		
22.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good LCD panel with glass to test logic board video output.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Is normal video restored?</p>	Yes	Go to step 23.		
		No	Replace logic board. Reinstall user's LCD panel with glass. Verify issue resolved.	M04	MLB
23.	<p>Examine image on display and determine whether lines are vertical or horizontal.</p> <p>Are lines vertical or horizontal?</p>	Vertical	Replace LCD panel with glass. Verify issue resolved.	L27	LCD
		Horizontal	Replace LCD panel with glass. Verify issue resolved.	L26	LCD

	Check	Result	Action	Code	Commodity
24.	Inspect display closely and determine whether pixel “anomalies” are actually dust or debris on surface of glass panel.  Are anomalies caused by dust, debris, or other surface contamination?	Yes	Clean glass panel. Verify issue resolved.		
		No	Go to step 25.		
25.	Refer to Apple Support article <a href="#">HT4044: About LCD display pixel anomalies for Apple products released in 2010 and later</a> to determine whether number of anomalies exceeds specification. Determine whether number of bright or dark pixel anomalies (or a combination of these) exceed specification.  Does the number of pixel anomalies exceed the specified limit?	Yes	Replace LCD panel with glass. Verify issue resolved.	L20	LCD
		No	Explain to user that display is within specifications. Do not replace LCD panel with glass. Verify resolution.		
26.	Connect a compatible external display.  Does image on external display appear distorted and/or blurred?	Yes	Go to step 27.		
		No	Go to step 32.		
27.	A distorted or blurred image may be related to a failing memory module. Watch closely during startup sequence for exact point at which issue starts to occur.  Does issue occur BEFORE or AFTER Apple logo and spinning gear appears?	Before	Go to step 32.		
		After	Go to step 28.		
28.	To start up into Safe Mode, press power button; then as soon as you hear startup sound, hold down Shift key. Shift key should be held as soon as possible after startup sound, but not before sound. Release Shift key when you see gray Apple icon and the spinning gear.  Does issue still occur in Safe Mode?	Yes	Go to step 32.		
		No	Go to step 29.		
29.	Some models have RAM modules that are directly connected to the MLB. You are unable to remove the RAM on these models.  Are you able to remove RAM modules?	Yes	Go to step 30.		
		No	Go to step 32.		




	Check	Result	Action	Code	Commodity
30.	Perform one-by-one replacement of user's memory modules with known-good memory, reassemble and retest. Depending on computer model, this may simply require removal of the rear door, or the removal of LCD display and logic board to access the memory modules.	Yes	Replace memory module(s).  <b>Note:</b> Only replace defective memory module(s). There is no need to replace memory in pairs. Verify issue resolved.	X06	MEMORY
	<b>Note:</b> Be sure to always have at least the minimum amount of memory installed to support the computer and its OS. This may mean replacing a memory module with a known-good one of larger capacity for testing. For example, you may need to replace a 1 GB module with a known-good 2 GB module to support starting into OS X.  Does issue occur only with specific memory module(s)?	No	Go to step 31.		
31.	Install a known-good memory module in one memory slot and retest. Repeat test with known-good memory for each additional memory slot, one at a time.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.	M04	MLB
	Does issue occur only with a specific memory slot on logic board?	No	Go to step 32.		
32.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Go to step 33.		
	Remove LCD panel with glass and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.  Is DisplayPort cable or its connector damaged?	No	Go to step 35.		
33.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 34.		
	Refer to Apple Support article <a href="#">TP981: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit</a> or <a href="#">TP982: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Testing the Panel Using the Display Extension Cable Kit</a> for information about how to use extension cables.  Do you have immediate access to a known-good DisplayPort cable?	No	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
34.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.</p> <p>Is normal video restored?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.		
		No	Go to step 35.		
35.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.		
		No	Go to step 36.		
36.	<p>To completely troubleshoot this issue, a known-good LCD panel with glass is required.</p> <p>Do you have immediate access to a known-good LCD panel with glass?</p>	Yes	Go to step 37.		
		No	Replace LCD panel with glass. Verify issue resolved.		
37.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good LCD panel with glass to test logic board video output.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Is normal video restored?</p>	Yes	Replace LCD panel with glass. Verify issue resolved.	L04	LCD
		No	Replace logic board. Reinstall user's LCD panel with glass. Verify issue resolved.	M04	MLB
38.	<p>Determine whether variation in uniformity appears excessive when compared to a known-good similar computer.</p> <p>Does non-uniform brightness exceed that of a known-good computer?</p>	Yes	Go to step 39.		
		No	LCD seems to be within specifications. Do not replace LCD panel with glass. Verify resolution.		

	Check	Result	Action	Code	Commodity
39.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove LCD panel with glass. Inspect for mechanical interference from screws or cables making contact with back of LCD panel. Reseat components &amp; cables.</p> <p>Carefully clean all surfaces of any leftover tape or adhesive residue where panel contacts enclosure edges to ensure a good seal and a flat mating surface when display is resealed to these surfaces.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating internal components. Verify issue resolution.		
		No	Go to step 40.		
40.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Inspect and reseat backlight cable.</p> <p>Connect power cord to computer, wait 5 seconds for SMC to become ready, then press power button to start up computer.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating backlight cables. Verify issue resolution.		
		No	Go to step 41.		
41.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board. Reconnect all internal cables and reinstall LCD panel. Retest.</p> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.		
		No	Replace LCD panel with glass. Verify issue resolved.	L21	LCD

	Check	Result	Action	Code	Commodity
42.	Verify that display is listed in System Information > Hardware > Graphics/Displays > Video Card. This ensures that color profile can be matched with LCD.  Is display hardware detected?	Yes	Go to step 43.		
		No	Go to step 44.		
43.	Go to System Preferences > Displays > Color to make sure “iMac” is selected under Display profile. Inspect display again for incorrect or missing colors.  Are colors still incorrect or missing when display profile is set to “iMac”?	Yes	Go to step 44.		
		No	Issue resolved by setting a valid display profile. User may have created an off-color calibration setting. Verify resolution.		
44.	Run Mac Resource Inspector (MRI) to check for LCD presence.  Is LCD detected (green) in MRI?	Yes	Go to step 46.		
		No	Go to step 45.		
45.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat DisplayPort cable connector securely to logic board and retest.</p> <p>Connect power cord to computer, wait 5 seconds for SMC to become ready, then press power button to start up computer.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Is normal video restored?</p>	Yes	Issue resolved by reseating DisplayPort cable. Verify resolution.		
		No	Go to step 46.		
46.	Set desktop pattern in System Preferences > Desktop & Screen Saver > Desktop > Solid Colors to Solid Gray Light. Check to see whether incorrect/missing color issue affects entire screen.  Is entire screen affected?	Yes	Go to step 48.		
		No	Go to step 47.		
47.	Put computer side-by-side with a known-good equivalent iMac display showing same Solid Gray Light image.  Is issue noticeably worse on the user's display?	Yes	Go to step 48.		
		No	Small variations in color uniformity are normal and do not warrant replacement of display.		

	Check	Result	Action	Code	Commodity
48.	To troubleshoot this issue completely, a known-good LCD panel with glass is required.  Do you have immediate access to a known-good LCD panel with glass?	Yes	Go to step 49.		
		No	Replace LCD panel with glass. Verify issue resolved.	L02	LCD
49.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Substitute a known-good LCD panel with glass to test logic board video output.	Yes	Replace LCD panel with glass. Verify issue resolved.	L02	LCD
		No	Replace logic board. Reinstall user's LCD panel with glass. Verify issue resolved.	M04	MLB
	Is normal video restored?				
50.	Verify that display issue or anomaly has been resolved.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): No Video to External Display

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>External display is not detected when connected to computer</li><li>External display does not show any video</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Connect a known-good, compatible external display to computer's video-out port. Review Apple Support article <a href="#">HT3235: About Apple video adapters and cables</a> to help identify which adapters can be used with this computer model.</li><li>2. If using an Apple Thunderbolt Display, review Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a> to identify which computer models support it.</li><li>3. Review Apple Support article <a href="#">HT1573: Apple computers: Troubleshooting issues with video on internal or external displays</a> for common causes of video issues.</li><li>4. Launch System Information &gt; Hardware &gt; Graphics/Displays, select video card where internal Color LCD display is connected, and verify that external display hardware is recognized.</li><li>5. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>6. Check for and apply latest software and firmware updates to all involved computer(s) and display(s) (if applicable).</li><li>7. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear the startup sound for the second time. Refer to Apple Support article <a href="#">HT1379: About NVRAM and PRAM</a>.</li><li>8. If using with a computer set in target display mode, check that Thunderbolt cable is made by Apple (not third party) and that computer intended for use as target display actually supports target display mode via Thunderbolt. Refer to Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a>.</li><li>9. If using with a computer set in target display mode, reset SMC on computer used as a display. Refer to Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>10. If using an Apple Thunderbolt Display, review Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a> to verify that the computer has the latest Thunderbolt firmware version installed. Also review Apple Support article <a href="#">HT4614: About Thunderbolt to Thunderbolt cable (2 m)</a> for details on Thunderbolt cable usage and supported configurations.</li><li>11. If using a Mini DisplayPort adapter, review Apple Support article <a href="#">HT3382: Apple Mini DisplayPort adapters: Frequently asked questions (FAQ)</a>, for details on supported configurations.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized.</p>


Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.

Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.

For additional safety information and tips refer to Apple Support articles:

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch, Late 2012, Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Safety](#)
- [TP914: iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\): Safety](#)

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect video-out port for dust, debris, damage, or bent pins that might cause display cable to make insufficient contact. Use compressed air to remove any debris.  Is video-out port damaged?	Yes	Go to step 2.		
		No	Go to step 4.		
2.	Inspect logic board, video-out port, and enclosure for dents, scratches, or other indications of impact or abuse.  Can you identify signs of accidental damage?	Yes	Go to step 3.		
		No	Replace logic board. Verify issue resolved.	M24	MLB
3.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options  Does the user want to proceed with out-of-warranty repair?	Yes	Replace the logic board. Verify issue resolved.	M24	MLB
		No	Issue resolved. Return computer to user using correct positioning.		
4.	Connect known-good, compatible external display. Start up from a known-good up-to-date bootable OS X volume and check System Information > Hardware > Graphics/Displays device tree for presence of external display connected to graphics card.  Is external display detected?	Yes	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OS X build for this computer model. Verify issue resolved.		
		No	Replace logic board. Verify issue resolved.	M26	MLB
5.	Connect a known-good, compatible display to computer.  <ul style="list-style-type: none"> <li>Verify display is functional at computer startup.</li> <li>Verify display is functional after computer is put to sleep and then awakened.</li> <li>Verify other display features are also available (depending on display model: USB, audio, USB, Ethernet, and so forth).</li> </ul> Is issue resolved?	Yes	Issue resolved.		
		No	 <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple part repair.  Click the Help button in the GSX Toolbar then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Thunderbolt Target Display Mode Issues

## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## Quick Check



Symptoms	Quick Check
<ul style="list-style-type: none"><li>Computer does not initiate Thunderbolt target display mode connection</li><li>Thunderbolt-capable iMac does not switch to display mode when you press Command-F2 (target display mode trigger) on the iMac keyboard</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Check that Thunderbolt cable is made by Apple (not third party) and that computer intended for use as target display supports target display mode via Thunderbolt. Refer to Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a>.</li><li>Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Correct build includes Thunderbolt drivers that match logic board Thunderbolt controller.</li><li>Check for and apply latest software and firmware updates on both computers.</li><li>Check System Information &gt; Hardware &gt; Thunderbolt to verify that Thunderbolt hardware is recognized.</li><li>Try a known-good Thunderbolt to Thunderbolt cable (2 m).</li><li>Review the section entitled "How do I get the best performance from Thunderbolt?" in Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a> to verify that computer has latest Thunderbolt firmware version installed.</li><li>See Apple Support article <a href="#">HT4614: About Thunderbolt to Thunderbolt cable (2.0 m)</a>.</li><li>Make sure an Apple <b>aluminum</b> keyboard (wired or wireless) is being used. Earlier Apple and third-party keyboards will not activate Thunderbolt Target Display mode when pressing Command-F2.</li><li>Try using a known-good Thunderbolt-capable computer for target display mode. Refer to Apple Support article <a href="#">PH14264: OS X Mavericks: Use another Mac as a display</a>.</li><li>Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li><li>Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Correct build includes Thunderbolt drivers that match logic board Thunderbolt controller.</p> <p>Is proper OS X build installed?</p>	Yes	Go to step 2.		
		No	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OSX build and USB drivers for this computer model. Use Software Update to make sure newest revisions are installed. Verify issue resolved.		
2.	<p>Apply latest software and firmware updates. Check System Information &gt; Hardware &gt; Thunderbolt. If no device is connected, Thunderbolt controller should be listed as iMac, with unique user ID (UID) and firmware version shown.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 4.		
		No	Go to step 3.		
3.	<p>Reset PRAM by holding down the Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 4.		
		No	Go to “Thunderbolt Not Recognized” troubleshooting flow.		
4.	<p>Inspect Thunderbolt port(s) on user's computer for physical damage, burnt connectors, or misalignment.</p> <p>Does Thunderbolt port show any damage?</p>	Yes	Go to step 5.		
		No	Go to step 6.		
5.	<p>Check that physical damage or improper logic board mounting has not caused Thunderbolt ports to be out of alignment. Connect a Mini DisplayPort connector to Thunderbolt ports while mounting logic board to ensure proper alignment for cable insertion and removal. Rule out accidental damage before proceeding.</p> <p>Did logic board realignment correct Thunderbolt port issue?</p>	Yes	Go to step 6.		
		No	Replace logic board. Verify issue resolved.	M24	MLB

	Check	Result	Action	Code	Commodity
6.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>Thunderbolt-capable Mac</li> <li>Thunderbolt to Thunderbolt cable (2m)</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 7.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Request TCS help checking latest updates and System Information &gt; Hardware &gt; Thunderbolt device tree.</p> <p>Click Help button in GSX toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
7.	<p>Connect a known-good Thunderbolt to Thunderbolt cable (2 m) between user's computer and known-good Thunderbolt-capable iMac. Start up both computers to desktop, then press Command-F2 on known-good iMac to activate target display mode for user's computer. Verify all available Thunderbolt ports.</p> <p>Does known-good iMac become a target display for user's computer?</p>	Yes	Go to step 10.		
		No	Go to step 8.		
8.	<p>Check System Information &gt; Hardware &gt; Thunderbolt on user's computer to verify Thunderbolt port connection and port status. The connection to the known-good iMac should show as "Macintosh."</p> <p>Hardware &gt; Graphics &gt; Displays should show any displays recognized by user's computer and list Color LCD and iMac display information.</p> <p>Does System Information list target display mode information?</p>	Yes	Go to step 9.		
		No	Replace logic board. Verify issue resolved.	M32	MLB



	Check	Result	Action	Code	Commodity
9.	<p>Reseat both ends of known-good Thunderbolt to Thunderbolt cable (2 m). Shut down both computers, then start up to desktop. Press Command-F2 on known-good iMac to activate target display mode for user's computer. Verify that video from user's computer is visible on target display iMac.</p> <p>Check System Information &gt; Hardware &gt; Graphics &gt; Displays on user's computer to see if Color LCD and display iMac are present and activated.</p> <p>Verify all available Thunderbolt ports.</p> <p>Does System Information list target display mode information?</p>	Yes	Go to step 10.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Inform TCS that user's computer cannot activate target display mode on a known-good Thunderbolt iMac while it does show connection to Thunderbolt device tree.</p> <p>Click Help button in GSX toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
10.	<p>Continue using known-good Thunderbolt to Thunderbolt cable (2 m) between user's computer and known-good iMac. Shut down, then start up both computers to desktop. Press Command-F2 on user's iMac to activate target display mode for known-good iMac. Verify that video from known-good iMac is visible on target display of user's iMac. Check System Information &gt; Hardware &gt; Graphics &gt; Displays to see whether Color LCD and user's target display iMac are present and activated on known-good iMac.</p> <p>Is target display video present on user's iMac, and is user's iMac listed in Displays?</p>	Yes	Go to step 11.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Target display mode should work in both directions. Inform TCS that user's computer cannot be an active target display (as a second display) for known-good Thunderbolt iMac.</p> <p>Click the Help button in the GSX toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
11.	<p>Inspect user's Thunderbolt to Thunderbolt (2 m) cable for physical damage, such as contamination or burnt connectors on either end of cable.</p> <p>Is user's Thunderbolt cable damaged?</p>	Yes	Replace Thunderbolt to Thunderbolt (2m) cable. Verify issue resolved.	X26	EXTERNAL CABLE
		No	Go to step 12.		
12.	<p>Connect user's Thunderbolt to Thunderbolt (2 m) cable from user's computer to a known-good Thunderbolt-capable iMac. Start up both computers to desktop, then press Command-F2 on known-good iMac to activate target display mode for user's computer.</p> <p>Does known-good iMac become a target display for user's computer?</p>	Yes	Issue resolved. Verify resolution.		
		No	Replace Thunderbolt to Thunderbolt (2m) cable. Verify issue resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
13.	<p>Check System Information to confirm that Thunderbolt hardware is recognized and has a unique UID. Confirm current firmware version and link status.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Unstable Flickering

## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, fan, hard disk drive (HDD), HDD data cable, HDD power cable, left speaker, memory, power supply, rear enclosure, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Flickering video image</li><li>• Flickering backlight</li><li>• Dock and/or menu bar position not stable</li><li>• Display intermittently flashes on/off</li><li>• Unstable image</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>2. Check brightness setting.</li><li>3. Check for and apply latest software and firmware updates, especially those that deal with display issues. Remember that some external Apple display adapters also contain firmware that may need updating. For more information, refer to the following Apple Support articles:<ul style="list-style-type: none"><li>• <a href="#">HT1573: Apple computers: Troubleshooting issues with video on internal or external displays</a></li><li>• <a href="#">HT1599: Intel-based iMac: Installing available updates</a></li></ul></li><li>4. Clean glass panel and check for dust or debris.</li><li>5. Reset PRAM by holding down Command-Option-P-R keys while starting up until you hear the startup sound for the second time.</li><li>6. Reset SMC using the procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Adjust built-in display brightness setting to low backlight level, just above off.	Backlight	Go to step 2.		
	Verify whether user issue is due to backlight flickering or to an unstable or flickering video image on LCD.				
	<p>You may need to shine a bright (low heat) flashlight onto front of LCD with computer powered ON to verify whether a faint video image is occasionally visible through the flickering.</p> <p><b>Note:</b> If video is present but backlight never turns on, exit this procedure and go to 'No Backlight' issue instead. Use this procedure only for flickering backlight or video image.</p> <p>Which is flickering, backlight or video?</p>	Video	Go to step 8.		
2.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace LCD panel with glass, which includes display power cable. Verify issue resolved.	L03	LCD
	Inspect display power cable and its connectors between logic board and LCD panel with glass.	No	Go to step 3.		
	Is display power cable damaged?				
3.	Reseat display power cable between logic board and LCD panel with glass. Connect power cord to computer, wait 5 seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating display power cable. Verify issue resolution.		
	<p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>	No	Go to step 4.		
	Is normal video restored?				
4.	To troubleshoot this issue completely, a known-good LCD panel with glass is required.	Yes	Go to step 5.		
	Do you have immediate access to a known-good LCD panel with glass?	No	Replace LCD panel with glass. Verify issue resolved.	L03	LCD

	Check	Result	Action	Code	Commodity
5.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good LCD panel with glass.</p> <p>Is normal video restored?</p>	Yes	Replace LCD panel with glass. Verify issue resolved.	L03	LCD
		No	Go to step 6.		
6.	<p>To troubleshoot this issue completely, a known-good power supply is required.</p> <p>Do you have immediate access to a known-good power supply?</p>	Yes	Go to step 7.		
		No	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY
7.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good power supply.</p> <p>Is normal video restored?</p>	Yes	Replace power supply. Verify issue resolved.	P99	POWER SUPPLY
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
8.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove LCD panel with glass and inspect DisplayPort cable for misrouting. Disconnect DisplayPort cable from logic board. Inspect cable for pinching and cable connector for damaged or bent pins.</p> <p>Is DisplayPort cable or its connector damaged?</p>	Yes	Replace DisplayPort cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 9.		
9.	<p>Keep DisplayPort cable disconnected from logic board. Inspect DisplayPort connector on logic board for damaged or bent pins.</p> <p>Is logic board cable connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 10.		

	Check	Result	Action	Code	Commodity
10.	Reseat DisplayPort cable between LCD panel and logic board. Connect power cord to computer, wait 5 seconds for SMC to become ready, then press power button to start up computer.	Yes	Issue resolved by reseating DisplayPort cable. Verify issue resolution.		
	<p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is connected and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>	No	Go to step 11.		
	Is normal video restored?				
11.	To troubleshoot this issue completely, a known-good DisplayPort cable is required. The iMac Display Extension Cable Kit contains an Embedded DisplayPort (eDP) substitution cable that can be used for testing.	Yes	Go to step 12.		
	<p>Refer to Apple Support article <a href="#">TP981: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Testing the Panel Using the Display Extension Cable Kit</a> or <a href="#">TP982: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Testing the Panel Using the Display Extension Cable Kit</a> for information about how to use extension cables.</p> <p>Do you have immediate access to a known-good DisplayPort cable?</p>	No	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
12.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace DisplayPort cable. Verify issue resolved.	L14	INTERNAL CABLE
	Substitute a known-good eDP cable or use the eDP substitution cable found in the extension cable kit in place of suspect eDP cable.	No	Go to step 13.		
	Is normal video restored?				
13.	To troubleshoot this issue completely, a known-good LCD panel with glass is required.	Yes	Go to step 14.		
	Do you have immediate access to a known-good LCD panel with glass?	No	Replace LCD panel with glass. Verify issue resolved.	L03	LCD



	Check	Result	Action	Code	Commodity
14.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.	Yes	Replace LCD panel with glass. Verify issue resolved.	L03	LCD
		No	Replace logic board. Reinstall user's LCD panel with glass. Verify issue resolved.	M29	MLB
	Is normal video restored?				
15.	Confirm that the computer display flickering or unstable video issue is resolved.	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	L99	
	Is the issue resolved?				

# **iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Audio-in Jack Issues**


## **Unlikely causes:**

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, right speaker, solid-state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card


## **Quick Check**

Symptoms	Quick Check
<ul style="list-style-type: none"> <li>External audio-in port does not work with an analog or digital line-level source</li> </ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> <li>Press F12 key on keyboard to make sure that audio output is not muted.</li> <li>Ask user which type of audio input cable is connected to the computer's audio in jack: analog or optical cable.</li> <li>Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</li> <li>Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Update or restore if needed.</li> <li>Check that a known-good audio cable is used with its analog 3.5mm stereo miniplug end connected to proper input on computer and its other end connected to a compatible line-level audio source.</li> <li>Check that a known-good analog audio device (such as an iPod, iPhone, or other Mac computer) is used as source and is playing audio.</li> <li>On user's computer, go to System Preferences &gt; Sound and verify the following: <ul style="list-style-type: none"> <li>Input tab: <ul style="list-style-type: none"> <li>Line In input source is available and selected when an analog audio source is connected.</li> <li>"Input volume" slider is not set to zero (available only with an analog audio input).</li> </ul> </li> <li>Output tab: <ul style="list-style-type: none"> <li>Sound output device is set to Internal Speakers.</li> <li>Output volume is not muted or set to zero.</li> </ul> </li> </ul> </li> <li>Open QuickTime Player. Choose New Audio Recording from File menu. Choose "Built-in Input: Line In" input source from right pop-up menu, and adjust sound volume using slider in center of window.</li> <li>If audio is heard, verify user's cable and audio device using same process. <b>Note:</b> Disconnecting an analog stereo miniplug cable from the iPod/iPhone side will pause the audio playback.</li> <li>Perform visual and mechanical inspection of audio input and output jacks. Use an otoscope to inspect for dust and/or debris. Use compressed air to clean and remove any dust and/or debris.</li> <li>Reset PRAM by holding down Command-Option-P-R keys while restarting until you hear the startup sound a second time.</li> </ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li> <li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>

## Deep Dive


	Check	Result	Action	Code	Commodity
1.	Play a known-good audio file or reliable Internet radio station via iTunes. Verify that sound is clearly audible and free of distortion through both headphones and internal speakers.  Does the audio file play correctly?	Yes	Go to step 3.		
		No	Go to step 2.		
2.	Specify whether playback from known-good audio source is distorted or not audible.  Is sound distorted or not audible?	Distorted	Go to “Distorted Audio from Internal Speaker(s)” troubleshooting flow.		
		Not Audible	Go to “No Audio from Internal Speaker(s) or Headphone Jack” troubleshooting flow.		
3.	Hold down Command-R during startup to restart from recovery partition, and try to reproduce audio input issue using known-good audio sources and cables.  Does audio issue persist with known-good OS?	Yes	Go to step 4.		
		No	Restore OS with correct Mac OS X build. See Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> . Verify issue resolution.		
4.	From user information, identify whether analog line-in or optical digital-in is causing issue.  Which audio input is affected: analog line-in or optical digital-in?	Analog Line-in	Go to step 5.		
		Optical Digital-in	Go to step 10.		
5.	To troubleshoot this issue completely, a known-good 3.5mm stereo cable is required.  Do you have immediate access to a known-good 3.5mm stereo cable?	Yes	Go to step 6.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Computer analog input cannot be tested without adequate 3.5mm male-to-male stereo miniplug cable. See Apple Support article <a href="#">PH13722: OS X Mavericks: Audio ports</a> for further information.</p>		
6.	Disconnect any cable from audio in (mic) port to verify default setting for audio in.  In System Preferences > Sound > Input, verify that the Line In audio input source is listed and that the Input volume slider is present.  Set Input volume to middle position.  Is Line In audio input available?	Yes	Go to step 8.		
		No	Go to step 7.		



	Check	Result	Action	Code	Commodity
7.	<p>Line-in activity appears to be stuck to optical digital-in mode:</p> <ul style="list-style-type: none"> <li>• Insert a 3.5mm stereo miniplug into the audio in port and then rapidly unplug it and plug it in several times to reset internal switches in the connector.</li> <li>• Verify whether System Preferences &gt; Sound &gt; Input reverts to Line In after plug insertion and removal.</li> <li>• Close and reopen Sound Preferences window to refresh list of current audio input sources.</li> </ul> <p>Does audio input in System Preferences revert to Line In after minijack insertion and removal?</p>	Yes	Issue resolved by resetting audio-in jack. To prevent the issue from recurring suggest that user check physical specifications of cable connectors previously connected to this jack.		
		No	Go to step 14.		
8.	<p>Play a known-good audio file or Internet radio station in iTunes, and verify that it plays through internal speakers.</p> <p>Connect 3.5mm male-to-male stereo miniplug cable between the audio in (mic) port and the audio out (headphone) port.</p> <p>In System Preferences &gt; Sound &gt; Output verify that Headphones audio output source appears and select it.</p> <p>In System Preferences &gt; Sound &gt; Input, select Line In, then adjust the Input volume slider to observe activity level without peaking at maximum.</p> <p>Does the bar graph at bottom of recording window show input activity?</p>	Yes	Go to step 9.		
		No	Go to step 14.		

	Check	Result	Action	Code	Commodity
9.	Open QuickTime Player and choose New Audio Recording from File menu.	Yes	Computer analog audio input appears to be performing to specifications. Verify issue resolved.		
	<p>In the new recording window, choose "Built-In: Line Input" source from input source right pop-up menu. Adjust volume using slider in center of window.</p> <p>Press record button to start recording. Record for several seconds, then click record button again to stop recording.</p> <p>Disconnect stereo cable from audio out (headphone) port to hear audio through internal speakers. If needed, press F11-F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio file or Internet radio.</p> <p>Play recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.		
10.	<p>To troubleshoot this issue completely, a known-good 3.5mm mini-TOSLINK optical cable is required.</p> <p>Do you have immediate access to a known-good 3.5mm mini-TOSLINK cable?</p>	Yes	Go to step 11.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Computer digital input cannot be tested without adequate 3.5mm mini-TOSLINK male-to-male optical cable. See Apple Support article <a href="#">PH13722: OS X Mavericks: Audio ports</a> for further information.</p>		
11.	Connect 3.5mm mini-TOSLINK cable to the audio out (headphone) port.	Yes	Go to step 12.		
	<p>In System Preferences &gt; Sound &gt; Output, verify that a Digital Out audio output source appears, and select it.</p> <p>Play a known-good audio file or Internet radio station.</p> <p>Audio out should switch to optical digital audio, and unplugged end of cable will emit a red light to indicate transmission of a digital audio stream.</p> <p>Is red light visible at unplugged end of mini-TOSLINK cable?</p>	No	Go to step 14.		



	Check	Result	Action	Code	Commodity
12.	Continue to play known-good audio.	Yes	Go to step 13.		
	<p>Connect other end of 3.5mm mini-TOSLINK cable to audio in (mic) port.</p> <p>Open QuickTime Player and choose New Audio Recording from File menu.</p> <p>In the new recording window, choose "Built-in Input: Digital In" from the input source pop-up menu, and adjust volume using slider in center of window.</p> <p>Does the bar graph at bottom of the recording window show input activity?</p>	No	Go to step 14.		
13.	Press record button to start recording. Record for several seconds. Press record button again to stop recording.	Yes	Computer digital audio input appears to be performing to specifications. Verify issue resolved.		
	<p>Disconnect optical cable from audio out (headphone) port to hear audio through internal speakers. Press F11 and F12 keys to adjust volume, and confirm that computer is able to play sound.</p> <p>Stop playing known-good audio.</p> <p>Play the recorded audio file.</p> <p>Does computer accurately reproduce sound recorded from audio input?</p>	No	Go to step 14.		
14.	Disconnect cable from audio in (mic). Open QuickTime Player and choose New Audio Recording from the file menu. Choose "Built-in Microphone: Internal Microphone" from the pop-up menu to record from an internal microphone input source. Compare distortion between recorded internal input and external input sources.	Yes	Replace logic board. Verify issue resolved.	M09	MLB
	<p>Is recorded sound also distorted when recorded from internal microphone input?</p>	No	Go to step 15.		

	Check	Result	Action	Code	Commodity
15.	Disconnect headphones or external speakers.	Yes	Issue resolved by reseating audio cable. Verify resolution.		
	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove LCD panel with glass.</p> <p>Inspect audio cable connector and its corresponding connector on logic board. Reseat connection and retest.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Is recorded sound audible, clear, and free of distortion?</p>	No	Go to step 16.		
16.	<p>To troubleshoot this issue completely, a known-good rear enclosure is required.</p> <p>Do you have immediate access to a known-good rear enclosure?</p>	Yes	Go to step 17.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Audio I/O ports are part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
17.	<p>Substitute a known-good rear enclosure with audio ports and retest recording.</p> <p>To do this, carefully place known-good rear enclosure near the user's computer, then temporarily plug audio flex cable from known-good rear enclosure into audio connector on the logic board inside user's computer.</p> <p>Is recorded sound audible, clear, and free of distortion?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Audio I/O ports are part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	Replace logic board. Verify issue resolved.	M09	MLB
18.	<p>Plug a known-good analog audio source into audio in jack, and verify that sound recorded is audible and free of distortion.</p> <p>Repeat with digital (optical) audio source.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Camera Issues

## Unlikely causes:

Battery, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Camera not detected</li><li>• No green LED for camera</li><li>• Excessive blooming</li><li>• Poor white balance</li><li>• Poor focus</li><li>• Green image</li><li>• Image distortion</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check for and apply latest software and firmware updates.</li><li>2. Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a>. Verify that correct version of OS X is installed.</li><li>3. Verify that camera lens and glass panel are clean and clear of contaminants.</li><li>4. Ask user about lighting conditions in his or her working environment. Dim lighting causes poor image quality. Overly bright lighting can bounce off surfaces onto subject and make image foggy.</li><li>5. Striped, textured, and mesh clothing can create moiré patterns in image.</li><li>6. Reset SMC using procedure for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>7. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li><li>8. Disconnect all USB devices and restart.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) and check test results to verify camera presence.	Yes	Go to step 3.		
	Does MRI detect the camera and LCD display panel?	No	Go to step 2.		

	Check	Result	Action	Code	Commodity
2.	Depending on computer model, the camera will be listed in System Information > Hardware > USB or Camera Device Tree. Verify that "FaceTime HD Camera (Internal)" is listed.  Does the camera appear in System Information?	Yes	Go to step 3.		
		No	Go to step 4.		
3.	Launch Photo Booth. Verify that green LED next to camera lights up. Make sure image looks normal.  Does the camera LED light up and the image appear normal?	Yes	Issue resolved. Verify resolution.		
		No	Go to step 4.		
4.	Check camera/microphone/ALS cable connection to camera and to logic board. Check cable connectors to camera and logic board for loose or broken wires or pins.  Does camera cable show any signs of damage?	Yes	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 5.		
5.	Inspect camera cable connector on logic board, looking for a missing connector, cracking housing, or bent or broken pins that may have lifted from logic board solder pads.  Does logic board connector show any signs of damage?	Yes	Replace logic board. Verify issue resolved.	M13	MLB
		No	Go to step 6.		
6.	Reseat camera cable securely to logic board. Check System Information again.  Does camera appear in System Information?	Yes	Go to step 7.		
		No	Go to step 8.		
7.	Launch Photo Booth. Verify that green LED next to camera lights up. Make sure image looks normal.  Does camera LED light up and image appear normal?	Yes	Issue resolved by reseating the camera/microphone/ALS cable. Verify resolution.		
		No	Go to step 10.		
8.	To troubleshoot this issue completely, a known-good camera/microphone/ALS cable is required.  Do you have immediate access to a known-good Camera/Microphone/ALS Cable?	Yes	Go to step 9.		
		No	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
9.	Substitute a known-good camera/microphone/ALS cable and retest.  Is camera working normally?	Yes	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 10.		
10.	To troubleshoot this issue completely, a known-good camera is required.  Do you have immediate access to a known-good camera?	Yes	Go to step 11.		
		No	Replace camera. Verify issue resolved.	X21	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
11.	Substitute a known-good camera and retest.	Yes	Replace camera. Verify issue resolved.	X21	OTHER ELECTRIC
	Is camera working normally?	No	Go to step 12.		
12.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 13.		
	Do you have immediate access to a known-good logic board?	No	Replace logic board. Verify issue resolved.	M13	MLB
13.	Substitute a known-good logic board and retest.  Is camera working normally?	Yes	Replace logic board. Verify issue resolved.	M13	MLB
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Distorted Audio from Internal Speaker(s)

## Unlikely causes:



Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, memory, power supply, stand, Wi-Fi/Bluetooth antennas, wireless card

## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Sound is distorted, fuzzy, crackly, etc.</li><li>• Symptom only appears in internal speaker.</li><li>• Symptom also appears in external speakers/headphones.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Test with known-good sound file.</li><li>2. Compare same sound and settings against a known-good similar model computer to make sure sound is indeed distorting.</li><li>3. In System Preferences &gt; Sound &gt; Output, adjust the Output volume, and use Balance slider to isolate left and right speakers and check if issue only happens with one speaker.</li><li>4. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li><li>5. If testing with iTunes, make sure both equalizer and preamp settings are set to "Flat."</li><li>6. Test audio output using more than one application or website.</li><li>7. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using known-good, up-to-date, bootable OS X volume. Play same known-good sound file and compare using internal speakers and known-good headphones or external speakers.	Yes	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OS X build. Verify resolution.		
	Is internal/external sound now audible, clear, and free of distortion?	No	Go to step 2.		
2.	Play known-good audio file on internal speakers, then connect known-good headphones or external speakers and compare for distortion.	Yes	Go to step 3.		
	Is sound also distorted through headphones or external speakers?	No	Go to step 6.		
3.	Disconnect headphones or external speakers.	Yes	Issue resolved by reseating audio cable. Verify resolution.		
	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove LCD panel with glass.</p> <p>Inspect audio cable connector and its corresponding connector on logic board. Reseat connection and retest.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Is sound from internal/external speakers audible, clear, and free of distortion?</p>	No	Go to step 4.		

	Check	Result	Action	Code	Commodity
4.	<p>To troubleshoot this issue completely, a known-good rear enclosure is required.</p> <p>Do you have immediate access to a known-good rear enclosure?</p>	Yes	Go to step 5.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Audio I/O ports are part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
5.	<p>Substitute a known-good rear enclosure with audio ports and retest.</p> <p>To do this, carefully place known-good rear enclosure near user's computer, then temporarily plug audio flex cable from known-good rear enclosure into audio connector on logic board inside user's computer.</p> <p>Is sound from internal/external speakers audible, clear, and free of distortion?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Audio I/O ports are part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	Replace logic board. Verify issue resolved.	M09	MLB

	Check	Result	Action	Code	Commodity
6.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Issue resolved by reseating speaker cable connection. Verify resolution.		
	<p>Remove LCD panel with glass.</p> <p>Locate affected speaker connection on logic board. Inspect speaker cable connector and its corresponding connector on logic board. Reseat connection and retest.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Is sound from affected internal speaker audible, clear, and free of distortion?</p>	No	Go to step 7.		
7.	Disconnect headphones or external speakers. In System Preferences > Sound > Output, move Balance slider all the way left then all the way right, testing sound output each time. Test full range of volume settings.	Yes	Go to step 8.		
	<p>Listen closely to higher range tones to determine whether both left and right speakers are achieving proper stereo playback and separation between channels.</p> <p>Does distortion issue affect both speakers?</p>	No	Go to step 10.		
8.	Remove LCD panel with glass. To troubleshoot this issue completely, a known-good (left or right) internal speaker is required.	Yes	Go to step 9.		
	Do you have immediate access to a known-good speaker?	No	Replace logic board. Verify issue resolved.	M09	MLB
9.	Substitute a known-good speaker and retest.	Yes	<p>Replace user's affected speaker. Verify issue resolved.</p> <p>Remember, if you are replacing the speakers on a Late 2012 model or later, speakers need to be replaced together as a pair.</p>	X09	OTHER ELECTRIC
	Is sound from known-good internal speaker audible, clear, and free of distortion?	No	Reinstall user's speaker. Replace logic board. Verify issue resolved.	M09	MLB

	Check	Result	Action	Code	Commodity
10.	Inspect and carefully clean affected speaker cone using a soft tissue to remove dust, debris, or foreign material such as metal fragments that easily adhere to the magnetic speaker. Reseat speaker connection and retest.  Is sound from affected speaker audible, clear, and free of distortion?	Yes	Issue resolved by cleaning the speaker membrane. Verify resolution.		
		No	Go to step 11.		
11.	To troubleshoot this issue completely, a known-good speaker is required.  Do you have immediate access to a known-good speaker?	Yes	Go to step 12.		
		No	Replace user's affected speaker. Verify issue resolved.  Remember, if you are replacing the speakers on a Late 2012 model or later, speakers need to be replaced together as a pair.	X09	OTHER ELECTRIC
12.	Substitute a known-good speaker and retest.  Is sound from affected speaker audible, clear, and free of distortion?	Yes	Replace user's affected speaker. Verify issue resolved.  Remember, if you are replacing the speakers on a Late 2012 model or later, speakers need to be replaced together as a pair.	X09	OTHER ELECTRIC
		No	Replace logic board. Reinstall user's speaker. Verify issue resolved.	M09	MLB
13.	Connect and disconnect external speakers/headphones, verifying that audio can be played from both external and internal speakers and that computer produces a clear, distortion-free sound.  Is the issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External Apple Bluetooth Peripherals

## Unlikely causes:


There are no unlikely causes for this issue.

## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>Apple Bluetooth keyboard, mouse, or trackpad won't pair with known-good computer</li><li>Apple Bluetooth device intermittently loses its connection</li><li>Data transfer with Apple Bluetooth device is too slow or times out</li><li>Apple Wireless Mouse or Magic Trackpad causes erratic cursor tracking</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Check for and apply latest software and firmware updates.</li><li>In System Preferences make sure Bluetooth is on and set to Discoverable.</li><li>If the device does not power on, install new or freshly charged batteries.</li><li>Attempt to pair user's Bluetooth device with a known-good computer, using Apple Support article <a href="#">TS3048: Troubleshooting wireless mouse and keyboard issues</a>.</li><li>Reset Bluetooth device or delete pairing (if applicable).</li><li>If Bluetooth pairs normally at your service location, research potential sources of interference in the user's environment, such as microwave ovens or cordless phones in the 2.4/5GHz range. See Apple Support article <a href="#">HT1365: Wi-Fi and Bluetooth: Potential sources of wireless interference</a>.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Confirm that device is one of the following: <ul style="list-style-type: none"><li>Apple Magic Mouse (Late 2009) and newer</li><li>Apple Wireless Keyboard (Late 2009) and newer</li><li>Apple Magic Trackpad</li></ul>	Yes	Go to step 2.		
		No	Advise user to consult Apple Support article <a href="#">TS3048: Troubleshooting wireless mouse and keyboard issues</a> , or for third-party devices, contact manufacturer for support, software/firmware updates, or service options.		
	Is Bluetooth device one of these models?				

	Check	Result	Action	Code	Commodity
2.	<p>Test device with latest version of <b>Bluetooth Diagnostics Utility</b>. If a fault is detected, record the Diagnostic Receipt Code.</p> <p>Does device pass all Bluetooth Diagnostics Utility tests?</p>		 <p><b>ESCALATION REQUIRED.</b></p> <p>Bluetooth device appears to be performing to specifications. There may be an issue with user's computer, or Bluetooth interference in user's environment.</p> <p>If the issue persists, contact TCS for additional support. Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		Yes			
		No	Go to step 3.		
3.	<p><b>Bluetooth Diagnostics Utility</b> can verify communication to an Apple Wireless Keyboard, Magic Mouse, or Magic Trackpad. Identify wireless device being tested.</p> <p>Is the device being tested an Apple Wireless Keyboard or a Magic Mouse/Trackpad?</p>	Apple Wireless Keyboard	Go to step 4.		
		Apple Magic Mouse/Trackpad	Go to step 5.		
4.	<p>Refer to Apple Support article <a href="#">OP52: Bluetooth Keyboard, Mouse and Magic Trackpad Screening Process</a> and specify fault reported by the Bluetooth Diagnostics Utility.</p> <p>Which symptom describes the fault?</p>	Device Loses Connection	Replace Apple Wireless Keyboard. <b>Enter Diagnostic Receipt Code as required.</b> Verify issue resolved.	K08	KEYBOARD
		Device Cannot Pair	Replace Apple Wireless Keyboard. <b>Enter Diagnostic Receipt Code as required.</b> Verify issue resolved.	K07	KEYBOARD
5.	<p>Refer to Apple Support article <a href="#">OP52: Bluetooth Keyboard, Mouse and Magic Trackpad Screening Process</a> and specify fault reported by Bluetooth Diagnostics Utility.</p> <p>Which symptom describes fault?</p>	Device Loses Connection	Replace Bluetooth device. <b>Enter Diagnostic Receipt Code as required.</b> Verify issue resolved.	K08	MOUSE
		Device Cannot Pair	Replace Bluetooth device. <b>Enter Diagnostic Receipt Code as required.</b> Verify issue resolved.	K07	MOUSE



	Check	Result	Action	Code	Commodity
6.	Pair replacement Bluetooth device with a known-good computer. Verify that device sustains a connection for several minutes without error.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External Apple Wired Keyboard and Mouse

## Unlikely causes:

There are no unlikely causes for this issue.


## Quick Check

Symptoms	Quick Check
<p>Apple wired USB keyboard or mouse does not function with user's computer, or shows one or more of the following symptoms:</p> <ul style="list-style-type: none"><li>• Mouse button(s) does not click</li><li>• Mouse scroll ball does not operate smoothly</li><li>• No mouse response</li><li>• Keyboard keys stick</li><li>• Keyboard keys loose or missing</li><li>• One or more keys do not respond when pressed</li><li>• No keyboard response at all</li><li>• Apple wired mouse causes erratic cursor tracking</li><li>• Apple wired keyboard or mouse is not recognized</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Try steps suggested in Apple Support articles <a href="#">HT1151: USB and FireWire Quick Assist</a> and <a href="#">HT1581: Troubleshooting Mighty Mouse and determining expected behavior</a>.</li><li>2. Disconnect all USB devices from user's computer except user's mouse or keyboard. Troubleshoot only one device at a time to help isolate issue.</li><li>3. Unplug keyboard or mouse from USB port, wait a few seconds, and reconnect it.</li><li>4. Connect keyboard or mouse to another USB port on user's computer.</li><li>5. Make sure USB connectors are plugged in completely and correctly.</li><li>6. Visually inspect USB connectors and ports for damage or debris.</li><li>7. Try operating user's mouse on another surface. Ask user about type of surface usually being used with mouse. Glossy or transparent surfaces, or those with repetitive patterns, may cause mouse-tracking errors or faulty mouse operation. Explain that solid, non-reflective, opaque surfaces work best. Surface should be clean, but not shiny.</li><li>8. Visually inspect user's keyboard or mouse for dirt, hair, liquid damage, or other debris. Check to see whether user has pets. Pet hair can lay across laser and cause intermittent mouse issues. Refer to Apple Support article <a href="#">HT3226: How to clean Apple products</a> for information on cleaning user's keyboard or mouse.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect user's USB keyboard or mouse to a free USB port on a known-good computer to determine whether issue is related to USB port on user's computer, or to user's USB peripheral.	Yes	Go to "USB Port Not Recognized" troubleshooting flow.		
	Does user's keyboard or mouse function when used with a known-good computer?	No	Go to step 2.		

	Check	Result	Action	Code	Commodity
2.	<p>Visually inspect the user's USB mouse or keyboard to verify that attached USB cable and/or connector is not damaged or frayed.</p> <p>Check user's keyboard or mouse for physical and/or liquid damage.</p> <p>On mice, verify that all mouse buttons click and laser tracking LED illuminates.</p> <p>On keyboards, verify that all keyboard buttons are present and can be depressed normally.</p> <p>Does the user's USB mouse or keyboard, or its attached cable or connector, show signs of damage?</p>	Yes	Go to step 3.		
		No	Go to step 7.		
3.	<p>Isolate damage issue to either user's wired USB keyboard or mouse.</p> <p>Which peripheral is damaged?</p>	USB Mouse	<p>Replace USB mouse.</p> <p>Verify issue resolved.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K15	MOUSE
		USB Keyboard	Go to step 4.		
4.	<p>Closely examine user's keyboard to determine exact nature of the issue.</p> <p>Look for any signs of liquid spill, liquid penetration, or liquid damage to keyboard.</p> <p>Is damage to user's keyboard related to liquid spill?</p>	Yes	<p>Replace USB keyboard.</p> <p>Verify issue resolved.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K90	KEYBOARD
		No	Go to step 5.		
5.	<p>Click each key to ensure all keys are not sticking in the down or up position.</p> <p>Is damage to user's keyboard related to sticky keys or slow key response?</p>	Yes	<p>Replace USB keyboard.</p> <p>Verify issue resolved.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	K05	KEYBOARD
		No	Go to step 6.		

	Check	Result	Action	Code	Commodity
6.	Look for any loose or missing keycaps.	Yes	Replace USB keyboard. Verify issue resolved.  <b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K27	KEYBOARD
	Is damage to user's keyboard related to loose or missing keycaps?	No	Replace USB keyboard. Verify issue resolved.  <b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	K16	KEYBOARD
7.	Isolate failure issue to either user's wired USB keyboard or mouse.	USB Keyboard	Replace USB keyboard. Verify issue resolved.	K15	KEYBOARD
	Which peripheral is malfunctioning?	USB Mouse	Go to step 8.		
8.	Click and roll mouse's scroll ball to check that it rolls freely in all directions, with no physical resistance.	Yes	Replace USB mouse. Verify issue resolved.	K06	MOUSE
	Is issue related to the scroll ball?	No	Go to step 9.		
9.	Click mouse's various buttons to verify they click properly, without sticking, each time they are pressed.	Yes	Replace USB mouse. Verify issue resolved.	K14	MOUSE
	Is issue related to the mouse button(s)?	No	Replace USB mouse. Verify issue resolved.	K26	MOUSE
10.	Verify that user's USB keyboard or mouse continues to function properly with user's computer.	Yes	Issue resolved.		
	Is issue resolved?	No	 <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple part repair.  Click the Help button in the GSX Toolbar then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Microphone Issues

## Unlikely causes:

Battery, camera, DisplayPort cable, fan, flash storage card/solid-state drive (SSD), hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card.

## Quick Check



Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Microphone not working.</li><li>• Microphone audio garbled.</li><li>• Line audio input functions properly.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. On user's computer go to System Preferences &gt; Sound and verify the following:<ul style="list-style-type: none"><li>◦ Input tab:<ul style="list-style-type: none"><li>▪ "Internal microphone" source is available and selected.</li><li>▪ Input volume slider is not set to zero.</li></ul></li><li>◦ Output tab:<ul style="list-style-type: none"><li>▪ Sound output device is set to Internal Speakers.</li><li>▪ Output volume is not muted or set to zero.</li></ul></li></ul></li><li>2. Go to System Preferences &gt; Sound &gt; Input tab, and verify that "Input level" indicator moves when speaking into microphone.</li><li>3. Launch QuickTime Player. Choose New Audio Recording from File menu. Choose Built-in Microphone from right pop-up menu, and adjust input volume using slider in center of window.</li><li>4. Check that no cables are inserted into audio input or output jacks. Use an otoscope to visually inspect both jacks. Use compressed air to clean and remove any debris.</li><li>5. Reset PRAM by holding down Command-Option-P-R keys while restarting until you hear the startup sound a second time.</li><li>6. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Update or restore if needed.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using restore partition or up-to-date, bootable OS X volume, and try to reproduce audio input issue using known-good audio sources and cables.  Does issue persist with a known-good OS?	Yes	Go to step 2.		
		No	Restore correct Mac OS X build. See Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> . Verify resolution.		
2.	Connect a pair of headphones to audio-out port.  Launch QuickTime Player and choose New Audio Recording from File menu.  In the new recording window, choose Built-in Microphone from right pop-up menu. Adjust input volume using slider in center of window.  Press red record button to start recording. Speak near microphone (top of display bezel, near camera) for several seconds, then click record button again to stop recording.  Play recorded audio file using headphones to monitor quality of recording. If needed, press F11-F12 keys to adjust volume. Confirm that computer is able to record accurately from internal microphone input.  Does computer accurately reproduce sound from internal microphone input?	Yes	Microphone appears to be performing to specification. Verify issue resolved.		
		No	Go to step 3.		
3.	Connect an iPhone Headset with Microphone to the external headphone jack port.  Launch QuickTime Player and choose New Audio Recording from File menu. Choose Built-In Microphone: External Microphone from the right pop-up menu. Adjust input volume using slider in center of window.  Press red record button to start recording. Speak near microphone for several seconds, then click record button again to stop recording.  Play recorded audio file using headphones to monitor quality of recording. If needed, press F11-F12 keys to adjust volume, and confirm that computer is able to record accurately from its built-in line-in input.  Does computer accurately reproduce sound from external line input?	Yes	Go to step 4.		
		No	Audio input issue is not limited to microphone input. Go to “Audio-In Jack Issues” troubleshooting flow.		

	Check	Result	Action	Code	Commodity
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
	Remove LCD panel with glass.	No	Go to step 5.		
	Locate and disconnect camera/microphone/ALS cable from logic board and inspect cable for damage.				
5.	Is cable damaged?	Yes	Replace logic board. Verify issue resolved.	M24	MLB
	Inspect camera/microphone/ALS cable connector port on logic board for damage.				
	Is logic board connector damaged?	No	Go to step 6.		
6.	Reconnect camera/microphone/ALS cable to logic board.	Yes	Issue resolved by reseating camera/microphone/ALS cable. Verify resolution.		
	Retest recording.	No	Go to step 7.		
	<b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>				
7.	Is recorded sound sample audible, clear, and free of distortion?	Yes	Go to step 8.		
	To troubleshoot this issue completely, a known-good camera/microphone/ALS cable is required.				
	Do you have immediate access to a known-good camera/microphone/ALS cable?	No	Replace camera/microphone/ALS cable. Verify issue resolved.	X19	INTERNAL CABLE



	Check	Result	Action	Code	Commodity
		Yes	Replace camera/microphone/ALS cable. Verify issue resolved.	X19	INTERNAL CABLE
8.	<p>Retest recording.</p> <p>Substitute a known-good camera/microphone/ALS cable to test with user's microphone assembly.</p> <p>Is recorded sound sample audible, clear, and free of distortion?</p>	No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Microphone is part of rear housing. Replace rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
9.	<p>Verify that internal microphone is available and selected. Record a sound sample using GarageBand or QuickTime Player to verify quality of audio during playback.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): No Audio from Internal Speaker(s) or Headphone Jack


## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, DisplayPort cable, fan, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, memory, power supply, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antennas, wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• No sound from internal speaker(s).</li><li>• No sound from left and/or right speaker channel.</li><li>• No sound from headphone jack.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Adjust volume controls to verify setting is above minimum, and audio is not muted.</li><li>2. Test with known-good stereo sound file.</li><li>3. Connect headphones or external speakers to external audio port. Verify in System Preferences &gt; Sound &gt; Output that Audio Out setting switches to Headphones, and whether audio can be played on external speakers.</li><li>4. Disconnect any device connected to external audio port. In System Preferences &gt; Sound &gt; Output, check that sound output device reverts to Internal Speakers. Use Balance slider to isolate left and right speakers and check whether issue is limited to one speaker.</li><li>5. Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time.</li><li>6. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>7. Check for and apply the latest software and firmware updates.</li><li>8. Start up the computer using a known-good, up-to-date, bootable OS X volume and retest.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Start up computer using known-good, up-to-date, bootable OS X volume. Play the same known-good sound file and compare using internal speakers and known-good headphones or external speakers.  Is sound now audible on both internal and external speakers?	Yes	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OS X build. Verify resolution.		
		No	Go to step 2.		
2.	Play known-good audio file on internal speakers, then connect known-good headphones or external speakers and check for presence of sound on external speakers.  Is sound issue limited to external headphones/speakers?	Yes	Go to step 3.		
		No	Go to step 4.		
3.	Disconnect headphones or external speakers.  Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.  Remove LCD panel with glass.  Inspect Audio Cable Connector to Audio i/o ports and its corresponding connection on logic board. Reseat connection and retest.  <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.</b>  Is internal/external sound now audible on both speakers?	Yes	Issue resolved by reseating audio cable. Verify resolution.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Audio I/O ports are part of the rear housing. Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
4.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Issue resolved by reseating speaker cable connections. Verify resolution.		
	Remove LCD panel with glass.  Locate speaker connections on logic board. Inspect speaker cable connectors and corresponding connectors on logic board. Reseat connections and retest.	No	Go to step 5.		
	<b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed. The power supply contains a high voltage capacitor that may remain charged for up to an hour after unplugging the computer.</b>				
	Is sound now audible on both speakers?				
5.	Disconnect headphones or external speakers. In System Preferences > Sound > Output, move Balance slider all the way left then all the way right, testing sound output each time.	Yes	Go to step 6.		
	Does missing audio issue affect both internal speakers?	No	Go to step 8.		
6.	To troubleshoot this issue completely, known-good, (left and right) internal speakers are required.	Yes	Go to step 7.		
	Do you have immediate access to known-good speakers?	No	Replace logic board. Verify issue resolved.	M09	MLB
7.	Substitute known-good speakers and retest.	Yes	Replace both user's speakers. Verify issue resolved.	X08	OTHER ELECTRIC
	Is sound from known-good internal speakers audible?	No	Reinstall user's speakers. Replace logic board. Verify issue resolved.	M09	MLB
8.	To troubleshoot this issue completely, known-good speakers are required.	Yes	Go to step 9.		
	Do you have immediate access to a known-good speaker?	No	Replace speakers. Verify issue resolved.	X08	OTHER ELECTRIC
9.	Substitute known-good speakers and retest.	Yes	Replace user's speakers. Verify issue resolved.	X08	OTHER ELECTRIC
	Is sound now audible on both speakers?	No	Replace logic board. Reinstall user's speakers. Verify issue resolved.	M09	MLB

	Check	Result	Action	Code	Commodity
10.	<p>Connect and disconnect external speakers/headphones, verifying that audio can be played from both external and internal speakers and that computer produces a clear, distortion-free sound.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): No Audio to External Display Speakers


## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Sound cannot be enabled on speakers of an external Thunderbolt display, Mini DisplayPort display, or a compatible HDMI display using a compatible HDMI adapter with audio support</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Verify that nothing is connected to the headphone/audio output port on the user's computer, which would prevent audio from routing to speakers. In System Preferences &gt; Sound &gt; Output, select "Internal Speakers" then play audio file to verify it can be played on computer.</li><li>Verify user's computer is using a known-good, compatible Thunderbolt display, Mini DisplayPort display, or HDMI display equipped with internal speaker(s), using a compatible Thunderbolt-to-HDMI adapter with audio support.</li><li>Refer to following Apple Support articles for more information:<ul style="list-style-type: none"><li><a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a></li><li><a href="#">HT3382: Apple Mini DisplayPort adapters: Frequently asked questions (FAQ)</a></li></ul></li><li>If the user is connecting to another Mac in Target Display Mode, the sound from primary Mac should be playable on external display Mac's speakers. Refer to Apple Support article <a href="#">PH14264: OS X Mavericks: Use another Mac as a display</a> for more information on how to do this.</li><li>If the user is using an HDMI display such as an HDTV, sound from user's Mac should be playable on the HDTV's speakers. Refer to Apple Support article <a href="#">PH13801: OS X Mavericks: Use a television as a display</a> for more information on how to do this.</li><li>In System Preferences &gt; Displays, verify that external display is detected and enabled.</li><li>In System Preferences &gt; Sound &gt; Output, select the available Thunderbolt, DisplayPort, or HDMI Output device type, depending on display model and connection.</li><li>In System Preferences &gt; Sound &gt; Output, adjust output volume and balance levels.</li><li>Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</li><li>Test audio output using more than one application or website.</li><li>Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>With display connected to computer, check for and apply the latest software and firmware updates.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect a known-good display, display cable, and adapter (if needed) to a known-good similar-generation computer. Check System Preferences &gt; Sound &gt; Output for an available Thunderbolt, DisplayPort, or HDMI Output device type. Select available device type, adjust output volume level, and play audio file/source.</p> <p>Can external display audio be enabled and play with known-good computer?</p>	Yes	Go to step 2.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
2.	<p>Connect known-good display, display cable, and adapter (if present) to user's computer. Check System Preferences &gt; Sound &gt; Output for an available Thunderbolt, DisplayPort, or HDMI Output device type. Select available device type, adjust output volume level, and play audio file/source.</p> <p>Can external display audio be enabled and play with user's computer?</p>	Yes	Go to step 4.		
		No	Go to step 3.		
3.	<p>Start up user's computer using recovery partition or an up-to-date, bootable OS X volume. Check System Preferences &gt; Sound &gt; Output for an available Thunderbolt, DisplayPort, or HDMI Output device type. Select available device type, adjust output volume level, and play audio file/source.</p> <p>Can external display audio be enabled and play when user's computer has a known-good OS?</p>	Yes	Reinstall OS X on user's computer. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Check for and apply latest software and firmware updates. Verify resolution.		
		No	Replace logic board. Verify issue resolved.	M09	MLB
4.	<p>Retest user's display, cable, and/or adapter one at a time to identify affected element. Check System Preferences &gt; Sound &gt; Output for an available Thunderbolt, DisplayPort, or HDMI Output device type. Select available device type, adjust output volume level, and play audio file/source.</p> <p>Can external display audio be enabled and play with user's computer?</p>	Yes	Issue resolved. Verify issue resolved.		
		No	Go to step 5.		
5.	<p>User's external display, cable and/or adapter appears to be causing the issue.</p> <p>What is the product brand?</p>	Apple display, cable, or adapter	Go to step 6.		
		Third-party display, cable, or adapter	Refer user to contact product manufacturer for further compatibility, software requirements information, or service.		



	Check	Result	Action	Code	Commodity
6.	<p>Issue appears to be related to an Apple product. Specify the product type.</p> <p>What type of Apple product?</p>	Apple display	Return computer to user. Enter Apple display serial number into GSX, locate its service guide, and troubleshoot display using a known-good computer.		
		Apple cable or adapter	Check for possible accidental damage. Replace Apple cable or adapter. Verify issue resolved.	X03	EXTERNAL CABLE
7.	<p>Play a known-good audio file/source and verify that sound output to all speakers is audible.</p> <p>Is the issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# Thunderbolt Cable Connectivity Issues


## Unlikely causes:

There are no unlikely causes for this issue.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Unable to access Thunderbolt peripherals.</li><li>• Thunderbolt shows no connection.</li><li>• Slow Thunderbolt performance.</li></ul> <p><b>Note:</b> These symptoms address issues with the Thunderbolt cable, not the computer's Thunderbolt port. If you suspect an issue with the computer after attempting Quick Check steps that follow, please back up and click on the “Troubleshoot another issue” button to select a functional area and issue that addresses issues with computer's Thunderbolt port instead.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check manufacturer's minimum system requirements for connectivity to user's Thunderbolt peripheral. Refer to Apple Support article <a href="#">HT4614: About Thunderbolt to Thunderbolt cable (2.0 m)</a>.</li><li>2. Check Thunderbolt presence in System Information. Complete following steps:<ul style="list-style-type: none"><li>◦ Connect user's Thunderbolt cable to available Thunderbolt port on user's computer or known-good computer supporting Thunderbolt.</li><li>◦ Connect opposite end of user's Thunderbolt cable to known-good Thunderbolt peripheral, such as:<ul style="list-style-type: none"><li>▪ Known-good computer supporting Thunderbolt target disk mode</li><li>▪ Apple Thunderbolt Display</li><li>▪ Other known-good Thunderbolt peripheral</li></ul></li><li>◦ Power on connected equipment and start up user's computer.</li><li>◦ Launch System Information. Verify computer's Thunderbolt port and cable connection status appear in System Information &gt; Hardware &gt; Thunderbolt. Link status should be: <b>2</b> (connected), not <b>7</b> (not connected).<ul style="list-style-type: none"><li>▪ Known-good computer supporting Thunderbolt target disk mode</li><li>▪ Apple Thunderbolt Display</li><li>▪ Other known-good Thunderbolt peripheral</li></ul></li></ul></li><li>3. Reverse Thunderbolt cable. Connect other end of cable to user's computer. Repeat step 2 above to check for Thunderbolt presence.</li><li>4. Disconnect user's Thunderbolt cable and reconnect to another available Thunderbolt port on user's computer (if available). Repeat step 2 to check for Thunderbolt presence.</li><li>5. Substitute known-good Thunderbolt to Thunderbolt cable (2m). Repeat step 2 to check for Thunderbolt presence.</li><li>6. Shut down user's computer, wait a few seconds, then restart it. Repeat step 2 to check for Thunderbolt presence.</li><li>7. Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>8. Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time. Repeat step 2 to check for Thunderbolt presence.</li><li>9. Check for and apply the latest software and firmware updates. Repeat step 2 to check for Thunderbolt presence.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect both Thunderbolt cable connectors for dust, debris, damage, bent pins, or other indications of accidental damage. Use compressed air to remove debris.  Closely inspect cable for signs of damage, excessive wear, kinks, breaks, bends, knots, being wound too tight, etc.  Did you find any damaged components?	Yes	Go to step 2.		
		No	Go to step 3.		
2.	Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.  Refer to Apple Support article <a href="#">OP18: SERVICE: Accidental Damage Repair Pricing for Mail-In Portables and Displays</a> .  Does user want to proceed with out-of-warranty repair?	Yes	Replace Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
		No	Issue resolved. Return computer to user using correct positioning.		
3.	Inspect user's Thunderbolt cable connectors connectors, and cable itself, for signs of excessive and/or unusual heat dissipation during operation.  Perform this check only after cable has been connected to a powered computer port for at least two minutes.  Did you find any signs of excessive heat in any part of the Thunderbolt cable or connector ends?	Yes	Replace Thunderbolt cable. Verify issue resolved.	X85	EXTERNAL CABLE
		No	Replace Thunderbolt cable. Verify issue resolved.	X26	EXTERNAL CABLE
4.	Verify connected Thunderbolt peripheral is recognized by computer when connected by user's Thunderbolt cable.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# Thunderbolt FireWire Adapter Connectivity Issues

## Unlikely causes:

There are no unlikely causes for this issue.


## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>No FireWire port present.</li><li>Unable to access FireWire resources.</li><li>FireWire shows no connection.</li><li>Slow FireWire performance.</li></ul> <p><b>Note:</b> These symptoms address issues with the Thunderbolt FireWire Adapter, not the computer's Thunderbolt port. If you suspect an issue with the computer after attempting Quick Check steps that follow, please back up and click on 'Troubleshoot another issue' button to select a functional area and issue that addresses issue with computer's Thunderbolt port instead.</p> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Launch System Information. Verify computer's FireWire port presence in System Information &gt; Hardware &gt; FireWire. Verify Thunderbolt FireWire Adapter presence in System Information &gt; Hardware &gt; Thunderbolt.</li><li>Try known-good Thunderbolt FireWire Adapter, FireWire hardware and cable with user's computer.</li><li>Using known-good Thunderbolt FireWire Adapter, FireWire hardware and cable, start up computer using Lion Recovery or an up-to-date, bootable OS X volume. Hold down Command (⌘) + R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>. Repeat step 1 above to check for Thunderbolt and FireWire presence.</li><li>Verify bus-powered FireWire devices are receiving adequate power from computer.</li><li>Check manufacturer's minimum system requirements for device. Refer to Apple Support article <a href="#">HT1151: USB and FireWire Quick Assist</a>.</li><li>Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li><li>Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time.</li><li>Check for and apply the latest software and firmware updates.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Inspect Thunderbolt FireWire Adapter connectors, cable, and body for dust, debris, damage, bent pins, or other indications of accidental damage. Use compressed air to remove debris.	Yes	Go to step 2.		
		No	Go to step 3.		
	Did you find any damaged components?				
2.	Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.	Yes	Replace Thunderbolt FireWire Adapter. Verify issue resolved.	X26	EXTERNAL CABLE
	Refer to Apple Support article <a href="#">OP18: SERVICE: Accidental Damage Repair Pricing for Mail-In Portables and Displays</a> .	No	Issue resolved. Return computer to user using correct positioning.		
	Does user want to proceed with out-of-warranty repair?				

	Check	Result	Action	Code	Commodity
3.	<p>Connect user's Thunderbolt FireWire Adapter to an available Thunderbolt port on user's computer. Start up computer completely and launch System Information.</p> <p>Verify FireWire port presence in System Information &gt; Hardware &gt; FireWire.</p> <p>Verify Thunderbolt FireWire Adapter presence in System Information &gt; Hardware &gt; Thunderbolt.</p> <p>Does user's Thunderbolt FireWire Adapter appear in both areas of System Information?</p>	Yes	Go to step 6.		
		No	Go to step 4.		
4.	<p>To troubleshoot this issue completely, a known-good Thunderbolt FireWire Adapter is required.</p> <p>Do you have immediate access to a known-good Thunderbolt FireWire Adapter?</p>	Yes	Go to step 5.		
		No	Replace Thunderbolt FireWire Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
5.	<p>Substitute a known-good Thunderbolt FireWire Adapter.</p> <p>Repeat System Information presence checks from previous steps using user's computer.</p> <p>Does known-good Thunderbolt FireWire Adapter now appear in both areas of System Information?</p>	Yes	Replace Thunderbolt FireWire Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
6.	<p>To continue troubleshooting this issue, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• FireWire 400/800 device, for example, hard drive or camera</li> <li>• FireWire 800 cable, or FireWire 800-to-400 adapter with FireWire cable</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 7.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
7.	Connect user's Thunderbolt FireWire Adapter to an available Thunderbolt port on user's computer. Connect adapter's FireWire port to a known-good, bus-powered FireWire device with a known-good FireWire cable or adapter/cable combination.	Yes	Go to step 10.		
	Start up computer. Verify FireWire device mounts to desktop or is available in an application that supports the device, for example, iMovie, QuickTime, or Photo Booth.  Does known-good FireWire device/cable combination mount to desktop or appropriate application?	No	Go to step 8.		
8.	To troubleshoot this issue completely, a known-good Thunderbolt FireWire Adapter is required.	Yes	Go to step 9.		
	Do you have immediate access to a known-good Thunderbolt FireWire Adapter?	No	Replace Thunderbolt FireWire Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
9.	Substitute a known-good Thunderbolt FireWire Adapter.	Yes	Replace Thunderbolt FireWire Adapter. Verify issue resolved.	X03	EXTERNAL CABLE
	Using same computer, cable, and external FireWire device, start up computer. Verify FireWire device mounts to desktop or is available in an application that supports the device, for example, iMovie, QuickTime, or Photo Booth.  Does known-good FireWire device/cable combination now mount to desktop or appropriate application?	No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
10.	Connect user's Thunderbolt FireWire Adapter to an available Thunderbolt port on user's computer. Connect user's FireWire cable or adapter/cable combination to known-good FireWire device and user's Thunderbolt FireWire Adapter.	Yes	Go to step 11.		
	Start up computer. Verify FireWire device mounts to desktop or is available in an application that supports the device.  Does known-good FireWire device mount to desktop with user's cable?	No	Advise user to replace their FireWire adapter and/or FireWire cable set.		

	Check	Result	Action	Code	Commodity
11.	<p>Connect user's FireWire device and cable or adapter/cable combination.</p> <p>Start up computer. Verify FireWire device mounts to desktop or is available in an application that supports the device, for example, iMovie, QuickTime, or Photo Booth.</p> <p>Does user's FireWire device/cable combination mount to desktop or appropriate application?</p>	Yes	Issue resolved. Verify resolution.		
		No	Review Apple Support article <a href="#">HT1151: USB and FireWire Quick Assist</a> with user. Check manufacturer's minimum system requirements for device. Verify issue resolved.		
12.	<p>Verify connected FireWire device is recognized by computer.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Thunderbolt Port Not Recognized


## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Computer does not recognize Thunderbolt devices.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Check for and apply latest software and firmware updates. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Correct build includes Thunderbolt drivers that match logic board Thunderbolt controller.</li><li>Check System Information &gt; Hardware &gt; Thunderbolt to verify that Thunderbolt hardware is recognized.</li><li>Try using a known-good Thunderbolt cable. See Apple Support article <a href="#">HT4614: About Thunderbolt to Thunderbolt cable (2.0 m)</a>.</li><li>Try using a known-good Thunderbolt device or a Thunderbolt-capable computer in target disk mode. Refer to <a href="#">PH13842: OS X Mavericks: Transfer files between two computers using target disk mode</a>.</li><li>Refer to Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a>.</li><li>Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time.</li><li>Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Correct build includes Thunderbolt drivers that match logic board Thunderbolt controller.</p> <p>Is proper OS X build installed?</p>	Yes	Go to step 2.		
		No	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OS X build and USB drivers for this computer model. Use Software Update to make sure newest revisions are installed. Verify issue resolved.		
2.	<p>Apply latest software and firmware updates. Check System Information &gt; Hardware &gt; Thunderbolt. If no device is connected, Thunderbolt controller should be listed as iMac with unique user ID (UID) and firmware version shown.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 3.		
		No	Go to step 4.		
3.	<p>Connect a known-good Thunderbolt device using a known-good Thunderbolt cable. Refresh System Information &gt; Hardware &gt; Thunderbolt. Thunderbolt port status should update, then show connected Thunderbolt device.</p> <p>Does System Information list connected Thunderbolt device?</p>	Yes	Go to step 7.		
		No	Go to step 5.		
4.	<p>Reset PRAM by holding down Command-Option-P-R keys while booting, until you hear startup sound for the second time.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Go to step 3.		
		No	Go to step 5.		
5.	<p>To troubleshoot this issue completely, a known-good logic board is required.</p> <p>Do you have immediate access to a known-good logic board?</p>	Yes	Go to step 6.		
		No	Replace logic board. Verify issue resolved.	M33	MLB
6.	<p>Substitute a known-good logic board and retest. Reset PRAM again and restart to desktop. Check System Information to verify Thunderbolt hardware.</p> <p>Does System Information list Thunderbolt hardware?</p>	Yes	Replace logic board. Verify issue resolved.	M33	MLB
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

	Check	Result	Action	Code	Commodity
7.	<p>Connect Thunderbolt cable from known-good Thunderbolt device to second Thunderbolt port. Wait for known good Thunderbolt device to mount. Refresh System Information &gt; Hardware &gt; Thunderbolt. Thunderbolt port status should update, then show connected Thunderbolt device.</p> <p>Does System Information list connected Thunderbolt device on second Thunderbolt port?</p>	Yes	Issue resolved. Verify resolution.		
		No	Replace logic board. Verify issue resolved.	M33	MLB
8.	<p>Check System Information to confirm that Thunderbolt hardware is recognized and has a unique UID, most recent firmware version, and correct link status.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): USB Port Not Recognized

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Standard USB devices not recognized or not powered.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Disconnect all USB devices.</li><li>Verify that user's USB device is compatible with computer. Refer to <a href="#">HT5172: Using USB 3 devices on Mac computers FAQ</a> for more information about compatibility with various USB devices.</li><li>Check to see whether user's USB device requires a specific driver to function properly.</li><li>Check for and apply latest software and firmware updates.</li><li>Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</li><li>Check System Information &gt; USB device tree to see whether computer recognizes internal USB devices (Bluetooth, IR, camera).</li><li>Test each USB port using a known-good Apple wired keyboard or mouse.</li><li>Verify that USB hubs being used have sufficient power.</li><li>Start up using up-to-date, bootable OS X volume; then check System Information &gt; USB device tree to see whether computer recognizes internal USB devices.</li><li>Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and verify that correct version and build of OS X is installed.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Disconnect all USB devices. Verify whether known-good Apple wired keyboard or mouse functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 5.		
		No	Go to step 2.		
2.	Is known-good Apple USB device functional and recognized?				
	Continue to use known-good Apple wired keyboard or mouse. Start up computer using known-good, up-to-date, bootable OS X volume. Verify whether known-good USB device functions correctly and is recognized in System Information > USB device tree.	Yes	Go to step 4.		
	Is a known-good Apple USB device functional and recognized?	No	Go to step 3.		

	Check	Result	Action	Code	Commodity
3.	Inspect USB ports for lint, debris, or other foreign material. Remove debris with an anti-static brush.	Yes	Issue resolved. Return computer to user, explaining that debris in USB port caused issue and what to do to prevent contamination in the future.		
	Is known-good Apple USB device functional and recognized?	No	Replace logic board. Verify issue resolved.	M15	MLB
4.	Use Disk Utility to repair the file directory on internal hard drive. Restart and verify whether a known-good USB device functions correctly and is recognized in System Information > USB device tree.	Yes	Issue resolved by directory repair in Disk Utility. Verify resolution.		
	Is known-good Apple USB device functional and recognized?	No	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and restore USB drivers by reinstalling correct system build of OS X. Verify issue resolved.		
5.	This computer can support one high-powered USB device (e.g., iPad, iPhone, USB hard drive) at a time.	Yes	Go to step 6.		
	<p><b>Note:</b> The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 500 mA. See Apple Support article <a href="#">HT4049: Apple Computers and Displays: Powering peripherals through USB</a> for more information.</p> <p>Do you have immediate access to a known-good, high-powered USB device that draws over 900 mA?</p>	No	Go to step 8.		
6.	Connect known-good, high-powered USB device to one of the computer's USB ports. In System Information > USB device tree, "Current Available (mA)" and "Extra Operating Current (mA)" should each report 900 mA.	Yes	Go to step 7.		
	<p><b>Note:</b> The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify that known-good USB device functions as expected.</p> <p>Does "Extra Operating Current" appear in System Information?</p>	No	Replace logic board. Verify issue resolved.	M38	MLB

	Check	Result	Action	Code	Commodity
7.	<p>Connect exact same high-powered USB device to next USB port. Make sure nothing is plugged into other port(s). Both “Current Available (mA)” and “Extra Operating Current (mA)” should each report 900 mA in System Information. Repeat action with every available USB port.</p> <p><b>Note:</b> The first USB device to draw more than 900 mA is allotted up to 1100 mA, while all subsequent devices are limited to 900 mA. Verify USB device operates as expected.</p> <p>Does “Extra Operating Current” appear in System Information?</p>	Yes	Go to step 8.		
		No	Replace logic board. Verify issue resolved.	M38	MLB
8.	<p>Try user's USB device with a known-good computer. Verify whether it functions normally and is recognized in System Information &gt; USB device tree.</p> <p>Is user's USB device functional and recognized?</p>	Yes	Issue resolved by testing USB ports and verifying user's USB device. Verify resolution.		
		No	<p>Advise user to do the following:</p> <ul style="list-style-type: none"> <li>• Contact USB device manufacturer for support.</li> <li>• Verify system requirements and Mac compatibility.</li> <li>• Find out whether device requires additional software.</li> </ul>		
9.	<ul style="list-style-type: none"> <li>• Confirm that a known-good USB device is functional and recognized.</li> <li>• Check System Information for correct power allocation to USB device.</li> </ul> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External USB ODD Noisy

## Unlikely causes:

There are no unlikely causes for this issue.


## Quick Check

Symptoms	Quick Check
<p><b>Note:</b> Be sure you understand what type of optical drive noise you should be concerned about and what noises you can safely ignore. The following lists help distinguish normal, functional optical drive sounds from noises that may indicate drive malfunction.</p> <p>Typical noises include sounds made during the following activities:</p> <ul style="list-style-type: none"><li>• Waking computer from sleep</li><li>• Burning a CD or DVD</li><li>• Inserting a disc</li><li>• Ejecting a disc</li><li>• Importing ("ripping") an audio CD in iTunes</li><li>• Playing a DVD</li><li>• Accessing an idle disc</li></ul> <p>Abnormal noises include the following:</p> <ul style="list-style-type: none"><li>• Grinding</li><li>• Loud, repeated clicking</li><li>• Scraping sounds</li><li>• Constantly seeking or cycling the eject mechanism with no disc inserted</li></ul> <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none"><li>• Noise during start up</li><li>• Noise during operation</li><li>• Noise when drive is copying or saving data</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Verify user's issue involves only abnormal sounds, as defined in symptoms.</li><li>2. Verify Apple USB SuperDrive is sitting flat on a surface with silver top facing upward. Do not attempt to operate SuperDrive on its side or upside-down.</li><li>3. Verify that optical drive is an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the iMac.</li><li>4. Compare optical drive noise to a known-good equivalent Apple USB SuperDrive. Use sound samples in Apple Support article <a href="#">HT1723: Mac notebooks with optical drives: Noises from the optical drive</a> to compare.</li><li>5. Verify noise issue does not involve waking computer. When starting up or waking from sleep, Apple USB SuperDrive may make unfamiliar noises. Refer to Apple Support article <a href="#">TS2224: Mac notebooks: Noise when powering on or waking from sleep is normal</a>.</li><li>6. Test user's optical disc in a known-good drive to rule out a media issue. Verify disc size and shape are within specification in Apple Support article <a href="#">HT2801: Apple Computers: Troubleshooting the slot-loading SuperDrive</a></li><li>7. Test Apple USB SuperDrive with known-good discs. Verify media is free to spin without scraping edge or surface of media.</li><li>8. Verify noise during seek activity is excessive. Seek noise should subside once disc is mounted.</li><li>9. Verify disc spin noise is excessive. Disc spin should cease 30 seconds after mounting disc in Finder.</li><li>10. Inspect Apple USB SuperDrive drive slot for obstructions (stuck disc, etc.)</li><li>11. Inspect Apple USB SuperDrive USB cable and USB connector for damage.</li><li>12. Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina 5K, Mid 2012), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.</li><li>13. Apple USB SuperDrive must be plugged directly into computer's USB port, and cannot be used while connected to a USB hub.</li><li>14. Leave Apple USB SuperDrive connected to user's computer and restart computer while pressing mouse button or keyboard Eject key to cycle optical drive.</li><li>15. If user is experiencing an issue using Apple USB SuperDrive with Microsoft Windows, try starting up computer with Apple USB SuperDrive already plugged in.</li><li>16. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li></ol>

## Deep Dive



	Check	Result	Action	Code	Commodity
1.	Check whether Apple USB SuperDrive is constantly seeking or cycling eject mechanism with no optical disc inserted. Optical drive should perform only one reset sequence and then rest idly, ready for media.  Does optical drive spin, seek, and/or reset continuously without an optical disc inserted?	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 2.		
2.	Closely inspect user's Apple USB SuperDrive to determine whether a disc or other debris is stuck inside.  Is a disc or other debris stuck in drive?	Yes	Go to step 3.		
		No	Go to step 4.		
3.	Refer to Apple Support article <a href="#">RP451: Apple USB SuperDrive</a> to open drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.  Retest Apple USB SuperDrive by inserting, mounting and ejecting a known-good optical disc.  Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Insert known-good optical disc, then eject disc. Listen carefully to Apple USB SuperDrive disc handling. Eject noise should consist of a pop as disc is released from motor hub, then gear movement as motor pushes disc out of slot. Repeat test several times.  Is disc eject noise abnormal and excessive over multiple trials?	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to step 5.		
5.	Disconnect Apple USB SuperDrive and retest for computer noise.  Has noise been eliminated?	Yes	Go to step 6.		
		No	Go to "Noise/Hum/Vibration" troubleshooting flow.		
6.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical drive sounds.  Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 7.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
7.	Substitute a known-good Apple USB SuperDrive and retest.  Has noise been eliminated?	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J04	OPTICAL
		No	Go to "Noise/Hum/Vibration" troubleshooting flow.		

	Check	Result	Action	Code	Commodity
8.	Verify Apple USB SuperDrive does not make any abnormal noises.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External USB ODD Not Recognized


## Unlikely causes:

There are no unlikely causes for this issue.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Discs cannot be inserted.</li><li>• Discs can be inserted, but are ejected immediately.</li><li>• Discs can be inserted, but are ejected after drive has spun up for a few seconds.</li><li>• Discs can be inserted and ejected, but do not appear in Finder.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Go to Finder Preferences &gt; General and make sure “CDs, DVDs, and iPods” is checked under “Show these items on the desktop.”</li><li>2. Make sure Apple USB SuperDrive is sitting flat on a surface with silver top facing upward. Do not attempt to operate SuperDrive on its side or upside-down.</li><li>3. Verify that optical drive is an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the iMac.</li><li>4. Inspect Apple USB SuperDrive drive slot for obstructions, such as a stuck disc.</li><li>5. Inspect Apple USB SuperDrive cable and USB connector for damage.</li><li>6. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina 5K, Mid 2012), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.</li><li>7. Apple USB SuperDrive must be plugged directly into computer's USB port and cannot be used while connected to a USB hub.</li><li>8. Leave Apple USB SuperDrive connected to user's computer and restart computer while pressing mouse button or keyboard Eject key to cycle optical drive.</li><li>9. If user is experiencing an issue using Apple USB SuperDrive with Microsoft Windows, try starting computer with Apple USB SuperDrive already plugged in.</li><li>10. Refer to Apple Support article <a href="#">HT2801: Troubleshooting the slot-loading SuperDrive</a>.</li><li>11. Connect Apple USB SuperDrive to known-good iMac, MacBook Pro (Retina 5K, Mid 2012), MacBook Air, or Mac mini (Early 2009 or later) to verify drive's functionality separately from user's computer.</li><li>12. Disconnect user's Apple USB SuperDrive and connect a known-good Apple USB SuperDrive to same USB port on user's computer to verify computer's functionality separately from user's drive. If issue persists, troubleshoot as a faulty USB port on user's computer.</li><li>13. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Connect user's Apple USB SuperDrive to an available USB port on user's computer and start up computer. Check System Information &gt; Hardware &gt; USB to verify presence of optical drive.</p> <p>Repeat this process using each USB port on user's computer to verify all of computer's USB ports are functioning.</p> <p>Does drive appear in System Information when connected to every USB port?</p>	Yes	Go to step 2.		
		No	Go to "USB Port Not Recognized" troubleshooting flow.		
2.	<p>Attempt to insert a known-good, properly formatted CD or DVD disc into Apple USB SuperDrive. Check whether disc auto-ejects either immediately or within a few seconds after drive has spun up.</p> <p>Does disc auto-eject shortly after insertion?</p>	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 3.		
3.	<p>After insertion, verify disc spins and disc volume mounts in Finder.</p> <p>Does drive mount known-good disc?</p>	Yes	Go to step 4.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J09	OPTICAL
4.	<p>Check to see whether Apple USB SuperDrive properly mounts then reads both known-good CD and DVD media.</p> <p>If only one type of media is recognized, there may be a laser issue.</p> <p>Can drive read both media types?</p>	Yes	Issue resolved.		
		No	Go to "External USB ODD Read-Write or Performance Issues" troubleshooting flow.		
5.	<p>Insert, mount, and eject both a known-good CD and known-good DVD.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	J99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External USB ODD Read-Write or Performance Issues

## Unlikely causes:


There are no unlikely causes for this issue.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Errors when writing to optical media</li><li>• Errors when reading from optical media</li><li>• Hangs when accessing or writing data</li><li>• Read or write speeds slower than expected</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Test user's optical media in known-good Apple USB SuperDrive connected to known-good computer.</li><li>2. Test known-good, compatible optical media in user's Apple USB SuperDrive connected to a known-good computer.</li><li>3. Go to System Information &gt; Hardware &gt; Disc Burning to compare actual disc burning specifications to user's expectations.</li><li>4. See Apple Support articles <a href="#">HT2543: About optical disc drive burning and write speeds</a> and <a href="#">HT2882: Factors that affect writing to or reading from optical media</a> to learn more about disc burning and how performance is affected by write speeds, media types, and software.</li><li>5. Make sure Apple USB SuperDrive is sitting flat on a surface with silver top facing upward. Do not attempt to operate SuperDrive on its side or upside-down.</li><li>6. Verify that the optical drive is actually an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside iMac.</li><li>7. Inspect Apple USB SuperDrive slot for obstructions (stuck disc, etc.)</li><li>8. Inspect Apple USB SuperDrive USB cable and USB connector for damage.</li><li>9. The Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina 5K, Mid 2012), MacBook Air, and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper drive operation. Verify user's configuration is supported.</li><li>10. The Apple USB SuperDrive must be directly plugged into computer's USB port and cannot be used while connected to a USB hub.</li><li>11. With Apple USB SuperDrive connected to user's computer, restart computer while pressing mouse button or Eject key to cycle optical drive.</li><li>12. If user is experiencing an issue using Apple USB SuperDrive with Microsoft Windows, try starting computer with Apple USB SuperDrive already plugged in.</li><li>13. Refer to Apple Support article <a href="#">HT2801: Troubleshooting the slot-loading SuperDrive</a>.</li><li>14. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect user's Apple USB SuperDrive to user's computer and start up computer. Insert media into Apple USB SuperDrive and listen for scraping or scratching noises as disc spins up. Eject disc and examine surface and edges for scrapes or scratches. Verify disc spins freely without optical drive scraping edge or surface.  Does media spin freely in drive?	Yes	Go to step 2.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
2.	Closely inspect user's Apple USB SuperDrive to determine whether disc or debris is stuck inside.  Is disc or debris stuck in drive?	Yes	Go to step 3.		
		No	Go to step 4.		
3.	Refer to Apple Support article <a href="#">RP451: Apple USB SuperDrive</a> to open drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.  Retest Apple USB SuperDrive by inserting, mounting and ejecting a known-good optical disc.  Is optical drive function fully restored?	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
4.	Verify optical drive can properly read known-good CDs.  Can optical drive read CDs?	Yes	Go to step 5.		
		No	Go to step 6.		
5.	Verify optical drive can properly read known-good DVDs.  Can optical drive read DVDs?	Yes	Go to step 7.		
		No	Go to step 6.		
6.	Check System Information > Hardware > USB to verify presence of optical drive.  Does optical drive appear in System Information?	Yes	Go to step 7.		
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.		
7.	Burn test data to CD and DVD media compatible with Apple USB SuperDrive. Verify burned media is recognized and readable by drive.  Can optical drive read its own burned media?	Yes	Go to step 8.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J03	OPTICAL
8.	To troubleshoot this issue completely, you will need an identical, known-good Apple USB SuperDrive with which to compare optical disc read and burn times.  Do you have immediate access to a known-good Apple USB SuperDrive?	Yes	Go to step 9.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL

	Check	Result	Action	Code	Commodity
9.	<p>Check read and burn times of user's Apple USB SuperDrive connected to a known-good computer. Using same media type and brand, compare these times against a known-good Apple USB SuperDrive connected to same computer.</p> <p>Does user's drive have significantly longer read or burn times than known-good drive?</p>	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J07	OPTICAL
		No	Issue resolved.		
10.	<p>Test all Apple USB SuperDrive functions and drive performance to verify a successful repair.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	J99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): External USB ODD Rejects, Does Not Accept, or Does Not Eject Media

## Unlikely causes:

There are no unlikely causes for this issue.


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Cannot insert a disc into drive.</li><li>• Cannot eject a disc from drive.</li><li>• Drive ejects discs immediately after insertion.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Verify Apple USB SuperDrive is on flat surface with silver top facing upward. Do not attempt to operate SuperDrive on its side or upside-down.</li><li>2. Verify that optical drive is actually an Apple USB SuperDrive, which has a longer USB cable, and not a MacBook Air SuperDrive, which has a slightly shorter cable that may not reach iMac's USB ports while sitting on a flat surface alongside the computer.</li><li>3. Inspect optical drive slot for obstructions (stuck disc, for example).</li><li>4. Inspect Apple USB SuperDrive USB cable and connector for damage.</li><li>5. Apple USB SuperDrive is designed exclusively for use with iMac, MacBook Pro (Retina 5K, Mid 2012), MacBook Air and Mac mini (Early 2009 or later). USB ports on other computers may not provide sufficient power to enable proper operation of drive. Verify user's configuration is supported.</li><li>6. Apple USB SuperDrive must be directly plugged into computer's USB port, and cannot be used while connected to a USB hub.</li><li>7. Leave Apple USB SuperDrive connected to user's computer and restart computer while pressing mouse button or keyboard Eject key to cycle optical drive.</li><li>8. If user is experiencing an issue using Apple USB SuperDrive with Microsoft Windows, try starting computer with Apple USB SuperDrive already plugged in.</li><li>9. Refer to Apple Support article <a href="#">HT2801: Apple Computers: Troubleshooting the slot-loading SuperDrive</a></li><li>10. Connect user's Apple USB SuperDrive to a known-good computer and attempt to use it, to verify drive's functionality separately from user's computer.</li><li>11. Connect a known-good Apple USB SuperDrive to user's computer. Attempt to use drive to verify computer's functionality separately from user's Apple USB SuperDrive.</li><li>12. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Connect user's Apple USB SuperDrive to an available USB port on user's computer and start up computer. Check System Information > Hardware > USB to verify presence of optical drive.	Yes	Go to step 2.		
		No	Go to "External USB ODD Not Recognized" troubleshooting flow.		
	Does optical drive appear in System Information?				

	Check	Result	Action	Code	Commodity
2.	Closely inspect user's Apple USB SuperDrive to determine whether a disc or other debris is stuck inside.	Yes	Go to step 3.		
		No	Go to step 4.		
	Is a disc or other debris stuck in drive?				
3.	Refer to Apple Support article <a href="#">RP451: Apple USB SuperDrive</a> to open drive enclosure and remove any stuck disc, dust, debris, or other foreign materials.  Retest Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc.	Yes	Issue resolved by removing stuck disc or debris from drive. Verify resolution.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J02	OPTICAL
	Is optical drive function fully restored?				
4.	Verify known-good disc can fit through enclosure slot.  Is clearance in enclosure slot sufficient for disc insertion?	Yes	Go to step 7.		
		No	Go to step 5.		
5.	Closely inspect entire Apple USB SuperDrive enclosure for dents, scratches, or other indications of impact or abuse.  Is insufficient clearance due to accidental damage?	Yes	Go to step 6.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
6.	Inform user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.  Does user want to proceed with out-of-warranty repair?	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J05	OPTICAL
		No	Issue resolved. Using proper positioning, return computer to user.		
7.	Inspect slot on optical drive assembly for proper disc clearance.  Is clearance in optical drive slot sufficient for disc insertion?	Yes	Go to step 12.		
		No	Go to step 8.		
8.	When a CD or DVD pops off spindle inside an optical drive (usually due to impact to drive) and remains in drive mechanism, the loose disc prevents slot from opening fully, creating a closed condition. Inspect slot in optical drive to determine whether it is closed or not accepting discs.  If disc slot is closed, inspect drive mechanism, especially drive enclosure, for evidence of drop damage.  <b>Note:</b> If disc slot is closed, but there is no sign of accidental damage, choose "NO" to the question below.  Is disc slot access closed due to accidental damage?	Yes	Go to step 6.		
		No	Go to step 9.		

	Check	Result	Action	Code	Commodity
9.	Inspect slot in Apple USB SuperDrive to determine if it is closed or not accepting discs because of a stuck disc.  Is disc slot access closed because of a stuck disc?	Yes	Go to step 3.		
		No	Go to step 10.		
10.	Make sure optical drive assembly is mounted into enclosure correctly and is properly aligned with enclosure slot opening.  Is drive assembly properly aligned with enclosure slot opening?	Yes	Go to step 12.		
		No	Go to step 11.		
11.	Refer to Apple Support article <a href="#">RP451: Apple USB SuperDrive</a> to open drive enclosure and align optical drive assembly with enclosure's bezel slot.  Retest Apple USB SuperDrive by inserting, mounting, and ejecting a known-good optical disc.  Is optical drive function fully restored?	Yes	Issue resolved. Apple USB SuperDrive alignment realigned disc inject function. Verify issue resolved.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
12.	Attempt to insert a known-good, properly formatted CD or DVD into Apple USB SuperDrive. Check whether disc auto-ejects either immediately or within a few seconds after drive has spun up.  Does disc immediately auto-eject?	Yes	Replace Apple USB SuperDrive. Verify issue resolved.	J01	OPTICAL
		No	Go to step 13.		
13.	After insertion, check if disc spins and disc volume mounts in Finder.  Does disc volume mount?	Yes	Go to step 14.		
		No	Go to "External USB ODD Read-Write or Performance Issues" troubleshooting flow.		
14.	Eject disc by dragging disc icon to Trash or selecting disc icon and pressing Eject key or Command-E on keyboard.  Does disc eject properly?	Yes	Issue resolved.		
		No	Replace Apple USB SuperDrive. Verify issue resolved.	J02	OPTICAL
15.	Insert, mount, and eject a known-good optical disc.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	J99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): HDD Noisy

## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, HDD data cable, HDD power cable, LCD panel with glass, left speaker, logic board, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, WiFi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<p><b>Note:</b> Be sure you understand what type of hard drive noise you should be concerned about, and what noises you can safely ignore. The following descriptions help distinguish normal, functional hard drive sounds from noises that may indicate drive malfunction.</p> <p>Noises such as occasional quiet chirping or beeping are typically normal hard drive sounds.</p> <p>Refer to Apple Support article <a href="#">TS3204: iMac: Evaluating System noises</a> to determine whether noise is within expected range.</p> <p>Abnormal noises such as grinding or loud, repeated clicking or scraping sounds may be indications of a more serious issue.</p> <p>Listen closely in a quiet environment for the following:</p> <ul style="list-style-type: none"><li>• Noise during start up</li><li>• Noise during operation</li><li>• Noise when drive copies or saves data</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p><b>Important:</b> Always ask whether the user's data has been backed up prior to repair.</p> <ol style="list-style-type: none"><li>1. Verify that user's issue involves only abnormal sounds, as defined in symptoms.</li><li>2. Compare hard drive noise to a known-good equivalent computer. Refer to Apple Support article <a href="#">TS3204: iMac: Evaluating normal noises</a> to determine if noise is within expected range.</li><li>3. Check for and apply latest software and firmware updates.</li><li>4. If the computer model is internally equipped with both a hard drive and a solid state drive (SSD), refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore process.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Use OS X Recovery to troubleshoot potential software issues and to verify hard drive presence. Hold down Command-R during startup to restart from recovery partition. Launch Disk Utility.	Yes	Go to step 2.		
	See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a> for more information.	No	Go to “Hard Drive/SSD/Flash Storage Not Mounting/Not Recognized/Read-Write Issues” troubleshooting flow.		
	Does hard drive appear in Disk Utility?				
2.	Verify that hard drive S.M.A.R.T. status in Disk Utility shows as Verified.	Yes	Go to step 3.		
	Is S.M.A.R.T. status Verified?	No	Go to “Hard Drive/SSD/Flash Storage Not Mounting/Not Recognized/Read-Write Issues” troubleshooting flow.		
3.	Use Disk Utility to repair hard disk directory.	Yes	Go to step 5.		
	Did Disk Utility repair directory or finish without error?	No	Go to step 4.		
4.	Consult Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to determine correct version and build of OS X for this iMac; then erase and reinstall.	Yes	Go to step 5.		
	<b>Important:</b> Always ask whether user’s data has been backed up prior to repair.	No	Go to “Hard Drive/SSD/Flash Storage Not Mounting/Not Recognized/Read-Write Issues” troubleshooting flow.		
	Did installation successfully finish and, did computer start up to the desktop?				
5.	Restart computer and listen closely for abnormal noise.	Yes	Issue resolved.		
	Has abnormal noise been eliminated?	No	Go to step 6.		
6.	Disconnect internal hard drive and start up from a known-good, up-to-date, bootable Mac OS X volume.	Yes	Go to step 7.		
	Has noise been eliminated?	No	Go to “Noise/Hum/Vibration” troubleshooting flow.		

	Check	Result	Action	Code	Commodity
7.	<p>To confirm that drive is mounted properly, remove hard drive and verify the following:</p> <ul style="list-style-type: none"> <li>Rubber vibration isolation bumper is properly installed around hard drive, and does not appear worn, cracked, out-of-position, or otherwise damaged.</li> <li>Hard drive bracket is securely positioned over hard drive, is fastened to rear enclosure with appropriate screws, and does not appear loose, bent, or otherwise damaged.</li> <li>Any other internal components that were loosened during take-apart process have been re-tightened. For example, power supply or speaker screws may need to be loosened to gain access to hard drive bracket. After this is done, these components must be re-tightened to ensure they do not cause noise due to loose components vibrating against other parts, or against enclosure, especially around the chin area.</li> </ul> <p>Are hard drive mounting components undamaged and installed properly?</p>	Yes	Go to step 8.		
		No	<p>Replace missing or damaged components:</p> <ul style="list-style-type: none"> <li>Hard drive bracket</li> <li>Rubber vibration isolation bumper</li> </ul>	X13	PIECE PART
8.	<p>To troubleshoot this issue completely, a known-good hard drive is required.</p> <p>Do you have immediate access to a known-good hard drive?</p>	Yes	Go to step 9.		
		No	Replace hard drive. Verify issue resolved.	H06	HDD
9.	<p>Substitute a known-good hard drive and retest.</p> <p>Has noise been eliminated?</p>	Yes	Replace hard drive. Verify issue resolved.	H06	HDD
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	

	Check	Result	Action	Code	Commodity
10.	Confirm that computer no longer makes any abnormal noises.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): HDD/SSD/Flash Storage Not Recognized/Not Mounting/Read–Write Issues


## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, CPU fan, DisplayPort cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card



## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>Boots to gray screen</li><li>Boots to blue screen</li><li>Displays flashing folder with question mark or prohibitive symbol</li><li>Cannot save documents</li><li>Displays read/write error message(s)</li><li>Hangs when accessing or saving data</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p><b>Important:</b> Always ask whether user's data has been backed up prior to repair.</p> <ol style="list-style-type: none"><li>Disconnect all peripherals and attempt to start up computer.</li><li>To restore default startup disk, reset PRAM by holding down Command-Option-P-R keys while starting up, until you hear startup sound for the second time.</li><li>Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>If the computer is internally equipped with both a hard disk drive (HDD) and a solid state drive (SSD)/flash storage, refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and Later): About Fusion Drive</a> for specific troubleshooting and restore processes.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>


## Deep Dive


	Check	Result	Action	Code	Commodity
1.	Start up from known-good original system media or up-to-date, bootable OS X volume.	Yes	Go to step 2.		
	Confirm that computer completes the startup process: chime > gray screen > Apple logo > spinning gear > login screen > desktop or installer screen.	No	Go to “Will Not Start Up” troubleshooting flow.		
	Does computer complete the startup process?				
2.	Run AST Storage Diagnostic on the user's computer and examine the results of the test.	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	
	Do all internal drive tests pass in Storage Diagnostic?	No	Go to step 3.		
3.	Examine Storage Diagnostic results for presence of an internal drive.	Pass	Go to step 4.		
	Did drive presence test PASS or FAIL?	Fail	Go to step 16.		
4.	Examine Storage Diagnostic results for SMART status.	Pass	Go to step 5.		
	Did SMART test PASS or FAIL?	Fail	Go to step 9.		
5.	Examine Storage Diagnostic results for Short Random Multi-Block Read Test.	Pass	Go to step 6.		
	Did Short Random Multi-Block Read Test PASS or FAIL?	Fail	Go to step 16.		
6.	Examine Storage Diagnostic results for File System Check.	Pass	Go to step 7.		
	Did File System Check PASS or FAIL?	Fail	Go to step 10.		
7.	Examine Storage Diagnostic results for Bootable Volume Presence Check.	Pass	Go to step 8.		
	Did Bootable Volume Check PASS or FAIL?	Fail	Go to step 10.		

	Check	Result	Action	Code	Commodity
8.	<p>Examine Storage Diagnostic results for Last OS Reinstall Check.</p> <p>Did Last OS Reinstall Check PASS or FAIL?</p>	Pass	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	
		Fail	Go to step 10.		
9.	<p>Identify the type of storage device affected:</p> <ul style="list-style-type: none"> <li>• Hard disk drive (HDD)</li> <li>• Flash storage/solid-state drive (SSD)</li> </ul> <p>Is the affected device an HDD or SSD?</p>	HDD	Replace the user's hard drive. Verify issue resolved.	H05	HDD
		SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H05	SSD
10.	<p>Restart while holding down the Command-R keys to start up from the recovery partition.</p> <p>Does computer start up from recovery tools partition?</p>	Yes	Go to step 12.		
		No	Go to step 11.		
11.	<p>If OS X is present but not able to restart from the recovery partition, or the partition is missing, consult Apple Support article <a href="#">HT4848: About Recovery Disk Assistant</a> to restore the partition. Restart from the new recovery partition, holding down Command-R during restart.</p> <p>Does computer start up from newly created recovery tools partition?</p>	Yes	Go to step 12.		
		No	Go to step 16.		
12.	<p>In Disk Utility, select the Partition tab, then click the Option button to verify that the partition table is correctly set to GUID. Try to repair the partition using Disk Utility.</p> <p>Does Disk Utility successfully repair the partition?</p>	Yes	Go to step 15.		
		No	Go to step 13.		

	Check	Result	Action	Code	Commodity
13.	<p>Connect the computer to a network with Internet access.</p> <p>Press Command-Option-R keys to start up the computer into the Internet recovery partition.</p> <p>Open Disk Utility and refer to instructions in Apple Support article <a href="#">TS4482: Partition a problematic drive two times before recommending service or replacement</a> to re-partition the internal hard drive.</p> <p>This will force a rewrite of the partition table.</p> <p>Does Disk Utility successfully partition the drive without any errors?</p>	Yes	Go to step 14.		
		No	Go to step 16.		
14.	<p>Quit Disk Utility and restore OS X software from Internet. Refer to Apple Support article <a href="#">HT4718: About OS X Recovery</a> for OS X recovery options and requirements.</p> <p>Does computer complete the start up process?</p>	Yes	Go to step 15.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	
15.	<p>Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.</p> <p>Do all internal drive tests pass in Storage Diagnostic?</p>	Yes	Issue resolved. Verify resolution.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	H99	

	Check	Result	Action	Code	Commodity
16.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.  Remove LCD panel with glass.  Attempt to isolate which mass storage component is involved with this issue: <ul style="list-style-type: none"> <li>• Hard disk drive (HDD)</li> <li>• Flash storage/solid state drive (SSD)</li> </ul> <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>	HDD	Go to step 17.		
		SSD	Go to step 23.		
		Is this an HDD or SSD Issue?			
17.	Disconnect and inspect hard drive cable. Look for damage on logic board connector and cable.  Check for damaged or corroded cable connector and missing or bent pins on logic board connector.  Did you find damage to hard drive cable or logic board connectors?	Yes	Go to step 18.		
		No	Go to step 19.		
18.	Damage to multiple parts requires an escalation to Apple TCS for repair approval.  Is damage limited to hard drive cable?	Yes	Replace hard drive cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	  <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple-part repair.  Click the Help button in the GSX toolbar, then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	P99	
19.	Reconnect the hard drive cable to the logic board.  Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.  Do all internal drive tests pass in Storage Diagnostic?	Yes	Issue resolved by reseating hard drive cable. Verify issue resolved.		
		No	Go to step 20.		

	Check	Result	Action	Code	Commodity
20.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• Hard drive</li> <li>• Hard drive cable</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 21.		
		No	Replace hard drive. Verify issue resolved.	H01	HDD
21.	<p>Substitute a known-good hard drive cable to test with user's hard drive.</p> <p>Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.</p> <p>Do all internal drive tests pass in Storage Diagnostic?</p>	Yes	Replace hard drive cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 22.		
22.	<p>Continue to use known-good hard drive cable and substitute a known-good hard drive.</p> <p>Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.</p> <p>Do all internal drive tests pass in Storage Diagnostic?</p>	Yes	Replace hard drive. Reinstall user's hard drive cable. Verify issue resolved.	H01	HDD
		No	Replace logic board. Reinstall user's hard drive and cable. Verify issue resolved.	M19	MLB
23.	<p>Disconnect and inspect SSD/flash storage. Look for damage on logic board connector and SSD/flash storage.</p> <p>Check for damaged or corroded card edge connectors and missing or bent pins on logic board connector.</p> <p>Did you find damage to SSD/flash storage or logic board connectors?</p>	Yes	Go to step 24.		
		No	Go to step 25.		
24.	<p>Damage to multiple parts requires an escalation to Apple TCS for repair approval.</p> <p>Is damage limited to SSD card or flash storage?</p>	Yes	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	P99	

	Check	Result	Action	Code	Commodity
25.	Reconnect SSD or flash storage to logic board.  Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.  Do all internal drive tests pass in Storage Diagnostic?	Yes	Issue resolved by reseating SSD/flash storage. Verify issue resolved.		
		No	Go to step 26.		
26.	To troubleshoot this issue completely, a known-good SSD or flash storage is required.  Do you have immediate access to known-good SSD/flash storage?	Yes	Go to step 27.		
		No	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
27.	Substitute a known-good SSD or flash storage.  Run AST Storage Diagnostic on the user's computer again, and examine the results of the test.  Do all internal drive tests pass in Storage Diagnostic?	Yes	Replace SSD/flash storage. Verify issue resolved.	H01	SSD
		No	Replace logic board. Reinstall the user's SSD/flash storage. Verify issue resolved.	M19	MLB
28.	Confirm that the computer can successfully start up from the internal hard drive/SSD/flash storage.  Is the issue resolved?	Yes	Issue resolved.		
		No	  <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple-part repair.  Click the Help button in the GSX toolbar, then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	H99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): SD Memory Card Cannot Be Inserted Into Slot


## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Cannot insert SD card into slot.</li><li>• Can insert SD card only part way into slot.</li><li>• Card slot does not align with enclosure.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check that user's SD card is not warped or damaged, and that metal contacts are clean, intact and corrosion-free.</li><li>2. Verify that SD card is the correct size. Card dimensions should be 32mm x 24mm x 2.1mm.  <b>Note:</b> Cards thicker than 2.1mm are too thick and may damage card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.</li><li>3. Verify that computer's SD card slot is not obstructed in any way. Use a flashlight to look into slot to make sure nothing is already inserted. If so, carefully remove obstruction from slot. Try to reinsert SD card again.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Insert known-good, formatted SD card into user's computer. Verify that it seats correctly.</p> <p>Does known-good SD card seat correctly when inserted?</p>	Yes	Issue resolved. Defective or incompatible SD card. Advise user to contact SD card vendor for support. Refer them to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.		
		No	Go to step 2.		
2.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove LCD panel with glass.</p> <p>Remove chin strap to avoid bending or damaging it while aligning logic board.</p> <p>Loosen but do not remove all logic board screws. You should be able to shift board position slightly, both left to right and up and down. Take care to avoid damaging cabling or other components while moving logic board.</p> <p>Insert known-good SD card again.</p> <p>Can you now insert known-good SD card correctly?</p>	Yes	Go to step 3.		
		No	Replace logic board. Verify issue resolved.	M27	MLB
3.	<p>Hold the SD card reader in position and tighten all SD card reader screws. Insert the known-good SD card again.</p> <p>Can you now insert and remove known-good SD card correctly?</p>	Yes	Issue resolved with logic board alignment. Verify resolution.		
		No	Replace logic board. Verify issue resolved.	M27	MLB
4.	<p>Verify that a known-good SD memory card can be fully inserted into and ejected from slot and that it seats correctly.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): SD Memory Card Not Recognized

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>SD card does not appear on desktop or in System Information.</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Make sure SD card is unlocked.</li><li>Check that user's SD card is not warped or damaged and that metal contacts are clean, intact, and corrosion free.</li><li>Verify that computer's SD card slot is not damaged or obstructed. Use a flashlight to inspect slot to make sure nothing is already inserted. If so, carefully remove obstruction from slot. Try to reinsert SD card.</li><li>Verify that SD card is the correct size. Card dimensions should be 32mm x 24mm x 2.1mm.  <b>Note:</b> Cards thicker than 2.1mm are too thick and may damage card slot if inserted. Thinner cards such as MultiMediaCards (MMC) are acceptable. Refer to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further specifications.</li><li>Consult Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> and check for compatible SD card type and format.<ul style="list-style-type: none"><li>SD card slot can accommodate cards that are Standard SD (Secure Digital) 4 MB to 2 GB, SDHC (Secure Digital High Capacity) 4 GB to 32 GB, and SDXC (Secure Digital Extended Capacity) 4GB to 2 TB. MMC cards can also be used in this slot.</li><li>While SDIO (Secure Digital Input Output) cards fit into and shouldn't damage card slot, they are not supported.</li><li>MiniSD and Micro SD cards require adapters.</li></ul></li><li>For a more specific SD card type or format (i.e., wireless-enabled SD card or other SD card) make sure the correct driver is installed. OS X supports only standard SD memory cards; other cards may require specific driver software.</li><li>Make sure Finder Preferences &gt; General is set to show External Disks.</li><li>Check for and apply latest software and firmware updates.</li><li>Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li><li>Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Insert a known-good, formatted SD card into user's computer. Verify that card seats correctly.  Does known-good SD card seat correctly when inserted?	Yes	Go to step 2.		
		No	Go to "SD Memory Card Cannot Be Inserted Into Slot" troubleshooting flow.		
2.	Verify that a known-good SD card appears in Disk Utility and mounts in Finder. Verify that computer can read data from and write data to card.  Can computer read from and write to known-good SD card?	Yes	Go to step 5.		
		No	Go to step 3.		
3.	Start up user's computer with restore partition or up-to-date, bootable OS X volume. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.  Verify that a known-good SD card appears and mounts in Disk Utility and Finder.  Can computer now read from and write to known-good SD card?	Yes	Repair permissions and directory using Disk Utility. If issue persists, restore OS X (with correct system build). Retest to verify resolution. Check that user has necessary driver software.		
		No	Go to step 4.		
4.	Check System Information to verify that SD card reader is listed in USB devices.  Does SD card reader appear in System Information?	Yes	Go to step 5.		
		No	Replace logic board, which includes SD card reader. Verify issue resolved.	M27	MLB
5.	Insert user's SD card into user's computer. Verify that it seats correctly.  Does user's SD card seat correctly when inserted?	Yes	Go to step 6.		
		No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.		
6.	Verify that SD card appears in left column of Disk Utility. If card does not appear, eject and reinsert card. If inserted too slowly, card may not appear.  Does SD card appear in Disk Utility?	Yes	Go to step 8.		
		No	Go to step 7.		

	Check	Result	Action	Code	Commodity
7.	Insert user's SD card into a known-good computer. Verify that computer can read data from and write data to SD card.	Yes	Repair permissions and directory on user's computer using Disk Utility. If issue persists, restore OS X (with correct system build). Retest to verify resolution. Check that user has necessary driver software.		
	Can a known-good computer read from and write to user's SD card?	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.		
8.	Verify that user's SD card volume appears in Disk Utility and mounts in Finder.	Yes	Go to step 10.		
	Does card volume mount in Finder or Disk Utility?	No	Go to step 9.		
9.	Format user's SD Card as OS X Extended Journaled with a GUID partition scheme.	Yes	Issue resolved by reformatting SD card. Verify resolution.		
	<p><b>Important:</b> Make sure user has a valid backup first. If formatting is successful, retest SD card by writing data to and retrieving data from card.</p> <p>Were you able to reformat, then write to and read from the card successfully?</p>	No	Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.		

	Check	Result	Action	Code	Commodity
10.	<p>Test user's SD card by writing data to and retrieving data from card.</p> <p>Were you able to write to and read from user's card successfully?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Verify issue resolved.</p> <p>If the issue persists, contact TCS for additional support.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
		No	<p>Defective or incompatible SD card. Advise user to contact SD card manufacturer for support. Refer user to Apple Support article <a href="#">HT3553: About the SD and SDXC slot</a> for further information.</p>		
11.	<p>Verify that user's computer can successfully read from and write to a known-good SD card.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Thunderbolt Target Disk Mode Issues

## Unlikely causes:

Battery, camera, camera/Microphone/ALS cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, power supply, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>Computer does not initiate Thunderbolt target disk mode connection.</li><li>Computer does not show Thunderbolt floating icon after holding down T key during startup</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Check for and apply latest software and firmware updates. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. The correct build includes Thunderbolt drivers that match the logic board Thunderbolt controller.</li><li>Check System Information &gt; Hardware &gt; Thunderbolt to verify that the Thunderbolt hardware is recognized.</li><li>Review the section entitled "How do I get the best performance from Thunderbolt?" in Apple Support article <a href="#">HT5219: Thunderbolt ports and displays: Frequently asked questions (FAQ)</a> to verify that the computer has the latest Thunderbolt firmware version installed.</li><li>Between similar Mac models, if both a Thunderbolt and a FireWire cable are connected while activating target disk mode, Thunderbolt-enabled device will be the default. If either a Thunderbolt or FireWire storage device are disconnected after successfully entering target disk mode, the corresponding icon should disappear from display. See Apple Support article <a href="#">HT4614: About Thunderbolt to Thunderbolt cable (2.0 m)</a>.</li><li>Try using a known-good Thunderbolt device or a Thunderbolt-capable computer in target disk mode. Refer to <a href="#">PH13842: OS X Mavericks: Transfer files between two computers using target disk mode</a>.</li><li>Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear startup sound for the second time.</li><li>Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li></ol>



## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model. Correct build includes Thunderbolt drivers that match logic board Thunderbolt controller.  Is the proper OS X build installed?	Yes	Go to step 2.		
		No	Refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and reinstall correct OS X build and USB drivers for this computer model. Use Software Update to make sure newest revisions are installed. Verify issue resolved.		



	Check	Result	Action	Code	Commodity
2.	Apply latest software and firmware updates. Check System Information > Hardware > Thunderbolt. If no device is connected, Thunderbolt controller should be listed as iMac with unique user ID (UID) and firmware version shown.  Does System Information list Thunderbolt hardware?	Yes	Go to step 4.		
		No	Go to step 3.		
3.	Reset PRAM by holding down Command-Option-P-R keys while booting, until you hear startup sound for the second time.  Does System Information list Thunderbolt hardware?	Yes	Go to step 4.		
		No	Go to “Thunderbolt Not Recognized” troubleshooting flow.		
4.	Inspect Thunderbolt ports on user's computer for physical damage, burnt connectors or misalignment.  Does Thunderbolt port show any damage?	Yes	Go to step 8.		
		No	Go to step 5.		
5.	To troubleshoot this issue completely, the following known-good parts are required: <ul style="list-style-type: none"> <li>Thunderbolt-capable Mac</li> <li>Thunderbolt to Thunderbolt cable (2 m)</li> </ul> Do you have immediate access to each of these known-good parts?	Yes	Go to step 6.		
		No	 <b>ESCALATION REQUIRED.</b> Request TCS help checking latest updates and System Information > Hardware > Thunderbolt device tree. Click the Help button in the GSX toolbar, then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	X99	
6.	Start up a known-good Thunderbolt-capable Mac in target disk mode by holding down T key. Connect known-good computer to user's computer using a known-good Thunderbolt cable. Start up user's computer and verify whether hard drive of the known-good computer appears on desktop of user's computer.  Verify all available Thunderbolt ports.  Does hard drive on known-good Mac mount to user's computer while using known-good cable?	Yes	Go to step 9.		
		No	Go to step 7.		

	Check	Result	Action	Code	Commodity
7.	<p>Verify that System Information &gt; Hardware &gt; Thunderbolt on user's computer lists Thunderbolt connection and target disk mode information for known-good computer.</p> <p>Does System Information list Thunderbolt target disk mode information?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support. Inform TCS that user's computer cannot mount hard drive on a known-good iMac while in Thunderbolt target disk mode, while it does show Thunderbolt connection in System Information.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
		No	Replace logic board. Thunderbolt hardware is present, but not fully functioning. Verify issue resolved.	M33	MLB
8.	<p>Check that physical damage or improper logic board mounting has not caused Thunderbolt port(s) to be out of alignment. Connect a Mini DisplayPort connector to Thunderbolt ports while mounting logic board to ensures proper alignment for cable insertion and removal. Rule out accidental damage before proceeding.</p> <p>Did logic board realignment correct the Thunderbolt port issue?</p>	Yes	Go to step 5.		
		No	Replace logic board. Verify issue resolved.	M24	MLB
9.	<p>Inspect user's Thunderbolt to Thunderbolt (2 m) cable for physical damage, such as contamination or burnt connectors on either end of the cable.</p> <p>Is user's Thunderbolt cable damaged?</p>	Yes	Replace Thunderbolt to Thunderbolt cable (2 m). Verify issue resolved.	X26	EXTERNAL CABLE
		No	Go to step 10.		
10.	<p>Connect user's Thunderbolt to Thunderbolt cable (2 m) to both computers. Start up known-good computer in target disk mode by holding down T key during startup. Restart user's computer and verify that known-good computer's hard drive mounts to desktop of user's computer.</p> <p>Does known-good computer's drive mount to user's desktop?</p>	Yes	Go to step 11.		
		No	Replace Thunderbolt to Thunderbolt cable (2 m). Verify issue resolved.	X26	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
11.	Continue verification of user's Thunderbolt to Thunderbolt cable (2 m) cable. Start up user's computer in target disk mode by holding down T key during startup. Restart known-good computer and verify that user's computer's hard drive mounts to desktop of known-good computer.  Does user's computer's drive mount to known-good computer's desktop?	Yes	User's iMac and Thunderbolt cable pass inspections. Thunderbolt target disk mode issue resolved. Verify resolution.		
		No	Go to step 12.		
12.	Substitute a known-good Thunderbolt to Thunderbolt cable (2 m) between known-good computer and user's computer. Restart user's computer in target disk mode by holding down T key during startup. Restart known-good computer and verify that user's computer's hard drive mounts to the desktop of known-good computer.  Does user's computer's drive mount to known-good computer's desktop?	Yes	Replace Thunderbolt to Thunderbolt cable (2 m). Verify issue resolved.	X26	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support. Inform TCS that user's computer can mount a known-good Thunderbolt target disk mode computer hard drive, but cannot support being a target disk for other hosts.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
13.	Check System Information to confirm that Thunderbolt hardware is recognized and has a unique UID, most recent firmware version, and correct link status.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Burnt Smell/Odor



## Unlikely causes:



Rear enclosure, stand


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Computer emits a burnt, smoky, or other unusual odor</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Verify that computer is source of odor.</li><li>Disconnect all third-party devices to eliminate external devices as source of odor.</li><li>Odors can be related to how new the product is. Refer to Apple Support article <a href="#">HT4921: New equipment: Odors may be present short-term</a>.</li><li>Determine whether this is a safety issue. Refer to Apple Support article <a href="#">OP44: SERVICE: Handling Potential Product Safety Issues</a>.</li><li>Inspect enclosure and components for obvious signs of burning or smoky residue. Check rear vents, slots, ports, and power cord. Refer to Apple Support article <a href="#">TS4039: Smoke emitted may be from failed component</a>.</li><li>Inspect air intake vents and outlets for any obstructions. Make sure air can flow freely into and out of enclosure.</li><li>Clean enclosure to eliminate odors resulting from external contamination. Refer to Apple Support article <a href="#">HT3226: How to clean Apple products</a>. Explain cause to user.</li><li>Verify functionality of computer. If computer is nonfunctional, troubleshoot that first as a separate issue.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Closely inspect computer for a possible safety issue.</p> <p>Have you identified any safety issues?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for safety-related issues. Click Help button in GSX toolbar &gt; Technical Help with a Repair &gt; Contact Apple.</p> <p>Refer to Apple Support article <a href="#">OP44: SERVICE: Handling Potential Product Safety Issues</a>.</p>	T99	
		No	Go to step 2.		
2.	<p>Odor can be related to external contamination. Inspect computer exterior for contamination or lack of cleanliness.</p> <p>Can you determine that odor is caused by external contamination?</p>	Yes	Go to step 3.		
		No	Go to step 4.		
3.	<p>Thoroughly clean entire enclosure and all external surfaces. Refer to Apple Support article <a href="#">HT3226: How to clean Apple products</a>. Explain cause to the user.</p> <p>Does user agree that odor is due to external contamination?</p>	Yes	Issue resolved. Verify resolution.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
4.	<p>Odors can be related to how new the product is. Refer to Apple Support article <a href="#">HT4921: New equipment: Odors may be present short-term</a>.</p> <p>Can you determine that odor is due to newness?</p>	Yes	Go to step 5.		
		No	Go to step 6.		

	Check	Result	Action	Code	Commodity
5.	<p>Explain to user that new computers can sometimes emit an odor similar to odors generated by new carpeting or a new car. In most cases, odor dissipates after a brief period. Refer user to Apple Support article <a href="#">HT4921: New equipment: Odors may be present short-term</a>.</p> <p>Does user agree odor is related to computer's newness?</p>	Yes	Issue resolved. Verify resolution.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
6.	<p>Inspect each module and its associated cables for signs of burnt or damaged components, smoke residue or other traces of burning, and melted or damaged wiring.</p> <p>Have you identified a component failure as source of odor?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS to troubleshoot burnt or failed components.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
		No	Go to step 7.		
7.	<p>Closely inspect internal components and enclosure for indications of physical damage or internal contamination.</p> <p>Can you identify signs of internal damage or contamination?</p>	Yes	Go to step 8.		
		No	Go to step 9.		
8.	<p>Inform the user that computer failures due to accidental damage are not covered under any Apple warranty, including AppleCare. If applicable, discuss out-of-warranty repair options.</p> <p>Does user want to proceed with out-of-warranty repair?</p>	Yes	Proceed with Out of Warranty repair. Verify resolution.		
		No	Issue resolved. Return computer to user using correct positioning.		

	Check	Result	Action	Code	Commodity
9.	<p>Run computer for several hours and check for the issue/odor. Test with both Apple Service Diagnostic (ASD) EFI and ASD OSX. If no functional failure is detected, use correct positioning to explain to user that odor is most likely related to external contamination or newness of computer.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	



# **iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Computer Runs Hot**

## **Unlikely causes:**


Battery, camera, camera/microphone/ALS cable, DisplayPort cable, HDD data cable, HDD power cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## **Quick Check**

Symptoms	Quick Check
<ul style="list-style-type: none"> <li>• Computer feels unusually warm.</li> <li>• Fan is not operating.</li> <li>• Fan is not functioning to its full capacity.</li> <li>• Fan runs constantly at high speeds.</li> </ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> <li>1. Run Mac Resource Inspector (MRI) to verify correct operation of sensors and fan.</li> <li>2. Check for and apply latest software and firmware updates.</li> <li>3. Inspect fan performance during operation to make sure fan is spinning. Check that the vents are not blocked, and if necessary, use compressed air to remove dust or debris from rear fan exhaust.</li> <li>4. Compare computer's operating temperature to a known-good, similarly configured computer.</li> <li>5. Check for runaway applications using Apple Support article <a href="#">TS1473: Runaway applications can shorten battery runtime, affect performance, and increase heat and fan activity</a>. Follow instructions to halt any processes that are using excessive system resources.</li> <li>6. Processor-intensive/graphics-intensive applications and system processes may cause the enclosure to feel warm. Use Activity Monitor to identify these types of programs and explain issue to user.</li> <li>7. Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li> <li>8. Verify that computer's internal hard drive or Solid State Drive (SSD)/flash storage is an Apple-installed part. Compare hard drive information in System Information to the Apple Hard Drives Matrix in Apple Support article <a href="#">SM155: Hard Drives Matrix</a> to determine whether user's installed drive is one of OEM drives available for this computer configuration. Third-party hard drives without correct firmware or thermal sensors, or outside this computer's specifications, may cause computer to run hot or permanently activate fan at full speed. In such cases, inform user that computer has been modified from its original, supported configuration, and that such a repair would not be covered under Apple warranty.</li> </ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run Mac Resource Inspector (MRI) to check for correct fan operation and current status of thermal sensors. MRI will report a failure if a fan isn't rotating or a sensor is undetected or exceeding thermal values.	Yes	Go to step 2.		
		No	Go to step 8.		
	Does computer pass all MRI checks?				
2.	Use the extended version of CSD to verify proper function of the following subsystems: <ul style="list-style-type: none"> <li>• SMC</li> <li>• Fan</li> <li>• Thermal sensors</li> <li>• CPU–heat sink thermal interface</li> </ul>	Yes	Computer passed all CSD checks. Verify operation and refer user to Apple Support article <a href="#">HT4543: Learn about the fans in your Mac.</a>		
		No	Go to step 3.		
	Does computer pass all CSD checks?				
3.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.  Remove LCD panel with glass.  Inspect fan and heat sink fin stacks. Partial disassembly of computer may be required to access fan and heat sink. Use an ESD-safe vacuum to remove any dust or debris. Reassemble and retest using CSD.  <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>	Yes	Issue resolved by cleaning airflow. Verify resolution.		
		No	Go to step 4.		
	Does computer pass all CSD checks?				
4.	To troubleshoot this issue completely, a known-good fan is required.  Do you have immediate access to known-good fan?	Yes	Go to step 5.		
		No	Replace non-rotating or slower fan. Verify issue resolved.	X22	OTHER ELECTRIC
5.	Substitute a known-good fan and retest using MRI and CSD.  Does computer now pass MRI checks and ASD loop tests?	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Go to step 6.		
6.	To troubleshoot this issue completely, a known-good logic board is required.  Do you have immediate access to a known-good logic board?	Yes	Go to step 7.		
		No	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB


	Check	Result	Action	Code	Commodity
7.	Continue to use known-good fan. Substitute a known-good logic board. Reassemble computer and retest with MRI.	Yes	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB
	Do both known-good fan and logic board pass MRI and run-in tests?	No	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
8.	A disconnected fan will prevent proper cooling and cause thermal sensors to exceed expected values.	Yes	Go to step 9.		
	Does MRI report a fan motor test failure?	No/Other	Go to step 15.		
9.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 10.		
	<p>Remove LCD panel with glass.</p> <p>Use <a href="#">TP913: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Functional Overview</a> or <a href="#">TP816: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Functional Overview</a> table to locate affected fan connection to logic board. Disconnect fan cable connector and inspect logic board and fan cable connector pins for damage.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Is there any cable or connector damage on fan or logic board?</p>	No	Go to step 12.		
10.	Identify whether fan, logic board, or both are damaged.	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	L99	
	Are both fan and logic board damaged?	No	Go to step 11.		


	Check	Result	Action	Code	Commodity
11.	Identify whether fan or logic board is damaged.	Fan	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
	Which part is damaged?	Logic Board	Replace logic board. Verify issue resolved.	M24	MLB
12.	Remove all fan screws and extract fan to reveal heat sink or fan air duct. Use an ESD-safe vacuum to remove dust or debris from inner side of heat sink fin stack. Clean fan rotor blades. Reinstall fan and reseat fan cable connection to logic board. Reassemble and retest with MRI.	Yes	Issue resolved by cleaning and reseating fan connection. Verify resolution.		
	Does computer pass fan motor check?	No	Go to step 13.		
13.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 14.		
	Do you have immediate access to a known-good fan?	No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
14.	Substitute a known-good fan, and retest using MRI.	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
	Does computer now pass fan motor check?	No	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB
15.	Any under/overheated, clogged, disconnected, shorted, or failing sensor will cause computer to operate fan at higher speed(s).	Yes	Go to step 16.		
	Does MRI report a Txxx thermal sensor test failure?	No/Other	Go to step 27.		
16.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 17.		
	<p>Remove LCD panel with glass.</p> <p>Accumulated dust in fan or heat sink may not permit proper cooling.</p> <ul style="list-style-type: none"> <li>Remove all fan screws and extract fan to reveal heat sink.</li> <li>Use an ESD-safe vacuum to remove dust or debris.</li> <li>Clean fan rotor blades using soft brush.</li> <li>Reinstall fan and reseat fan cable connection to logic board.</li> </ul> <p>Reassemble and retest with MRI.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Does MRI still report a Txxx thermal sensor test failure?</p>	No	Issue resolved by cleaning and reseating fan cable connection. Verify resolution.		

	Check	Result	Action	Code	Commodity
17.	Identify whether sensor is one of the following: TCXr, TC0p, TG0d, TG0p, TPCD, TA0p, TM0p, TM1p, TM2p, TM3p, Tm0p, Tm1p, Tm2p, Tb0p.  Is failing thermal sensor listed?	Yes	Replace logic board. Verify issue resolved.	M23	MLB
		No	Go to step 18.		
18.	Identify whether sensor currently failing MRI test is TH0o or TH1R.  Is TH0o or TH1R thermal sensor failing test?	Yes	Go to step 19.		
		No	Go to step 23.		
19.	Verify in Apple Support article <a href="#">SM155: Drives Matrix</a> that the installed hard drive or flash storage/SSD model is compatible with this computer configuration.  Is installed HDD/flash storage/SSD compatible with this model?	Yes	Go to step 20.		
		No	Unsupported HDD/SSD installed, or missing/incorrect hard drive thermal sensor. Check with user for out-of-warranty resolution. Verify resolution.		
20.	Identify the type of storage device affected:  <ul style="list-style-type: none"> <li>• TH0o - Hard Disk Drive (HDD)</li> <li>• TH0O - Hard Disk Drive (HDD)</li> <li>• TH1R - Flash Storage/Solid-State Drive (SSD)</li> </ul> Is the affected device an HDD or a flash storage/SSD?	HDD	Go to step 21.		
		Flash Storage/SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H85	SSD
21.	To troubleshoot this issue completely, a known-good HDD data cable is required.  Do you have immediate access to a known-good HDD cable?	Yes	Go to step 22.		
		No	Replace the user's hard drive. Verify issue resolved.	H85	HDD
22.	Substitute a known-good HDD data cable and retest using MRI.  Does computer now pass the THxx sensor check?	Yes	Replace the user's hard drive data cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	Reinstall user's HDD data cable. Replace the user's hard drive. Verify issue resolved.	H85	HDD
23.	Identify whether sensor currently failing MRI test is Tp2h.  Is Tp2h thermal sensor failing test?	Yes	Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
		No	Go to step 24.		

	Check	Result	Action	Code	Commodity
24.	<p>Identify whether sensor currently failing MRI test is TL0p or TL1p.</p> <p>Is TL0p or TL1p thermal sensor failing test?</p>	Yes	Go to step 25.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
25.	<p>To troubleshoot this issue completely, a known-good LCD panel with glass is required.</p> <p>Do you have immediate access to a known-good LCD display panel with glass?</p>	Yes	Go to step 26.		
		No	Replace LCD panel with glass. Verify issue resolved.	L85	LCD
26.	<p>Substitute a known-good LCD panel with glass, and retest using MRI.</p> <p>Does MRI still report a TL0p or TL1p thermal sensor test failure?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	L99	
		No	Replace LCD panel with glass. Verify issue resolved.	L85	LCD



	Check	Result	Action	Code	Commodity
27.	<p>Other voltage and current sensors are also tested by MRI. Any failure to read them or any unexpected value will lead MRI to report a test failure.</p> <p>Does MRI report a Vxxx or lxxx test failure?</p>	Yes	Go to step 28.		
		No/Other	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
28.	<p>Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>Remove LCD panel with glass.</p> <p>Some power-related sensors are located in power supply, but are read through a SMBus connection to logic board.</p> <p><b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b></p> <p>Does MRI report a VDxx or IDxx test failure?</p>	Yes	Go to step 29.		
		No/Other	Go to step 32.		
29.	<p>Reseat DC power cable connection to logic board. Reassemble and retest, using MRI.</p> <p>Does MRI still report a VDxx or IDxx sensor test failure?</p>	Yes	Go to step 30.		
		No	Issue resolved by reseating DC power cable connection between power supply and logic board. Verify resolution.		
30.	<p>To troubleshoot this issue completely, a known-good power supply is required.</p> <p>Do you have immediate access to a known-good power supply?</p>	Yes	Go to step 31.		
		No	Reinstall user's DC power cable. Replace power supply. Verify issue resolved.	P17	POWER SUPPLY

	Check	Result	Action	Code	Commodity
31.	Substitute a known-good power supply, reassemble and retest using MRI.	Yes	Reinstall user's DC power cable and power supply. Replace logic board. Verify issue resolved.	M18	MLB
	Does MRI still report a VDxx or IDxx sensor test failure?	No	Reinstall user's DC power cable. Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
32.	Most voltage and current regulators are located on logic board. To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 33.		
	Do you have immediate access to a known-good logic board?	No	Replace logic board. Verify issue resolved.	M18	MLB
33.	Substitute a known-good logic board, reassemble and retest using MRI.	Yes	Reinstall user's logic board. Replace power supply. Verify issue resolved.	P17	POWER SUPPLY
	Does MRI still report a Vxxx or lxxx sensor test failure?	No	Replace logic board. Verify issue resolved.	M18	MLB
34.	Verify that computer no longer overheats during use.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Mechanical/Physical/Cosmetic Damage


## Unlikely causes:

There are no unlikely causes for this issue.

## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"> <li>• Broken glass</li> <li>• Bent stand</li> <li>• Broken hinge</li> <li>• Stripped screw/head</li> <li>• Stripped screw boss/threads</li> <li>• Dented or scratched enclosure</li> <li>• Cracked LCD</li> <li>• Scorched or melted LCD</li> <li>• LCD impact damage</li> </ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<p>Inspect computer and discuss nature of issue with user. Determine whether user wants to proceed with repair (despite possible accidental damage) or pursue other service options. Click "No" to proceed with further troubleshooting.</p>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	<p>Determine cause of damage or defect: user/technician, environment, accidental damage, or abuse.</p> <p>Is an Apple agent responsible for damage or defect on computer?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for assistance with Apple-related accidental damage.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	<p>Proceed with resolution or repair using proper positioning. Inform user that computer failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p>	L99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Noise/Hum/Vibration

## Unlikely causes:

Battery, camera, camera/microphone/ALS cable, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, logic board, memory, rear enclosure, right speaker, solid state drive (SSD)/flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card

## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Buzzing noise</li><li>• Rattling noise</li><li>• Ticking noise</li><li>• Squeaking noise</li><li>• Humming noise</li><li>• High frequency noise</li><li>• Mechanical vibration</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Work with user to reproduce issue and isolate source of noise. Differentiate whether noise is coming from computer or a connected peripheral. Disconnect all third-party peripherals to isolate source of noise.</li><li>2. Determine whether sound is normal or abnormal. Refer to Apple Support article <a href="#">TS3204: iMac: Evaluating System noises</a> for more information.</li><li>3. If iMac fan runs at full speed after computer turns on, you may need to reset iMac's SMC. Refer to Apple Support articles <a href="#">TS1433: iMac: Fans run at full speed after computer turns on</a> and <a href="#">HT4543: Learn about the fans in your Mac</a> for more information. Reset SMC using procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>4. Verify that vents on bottom and back of computer are free of dust and other obstructions that might inhibit proper airflow through computer.</li><li>5. Launch Applications &gt; Utilities &gt; Activity Monitor. Determine whether an application or process is consuming a high percentage of CPU bandwidth. CPU-intensive applications can cause fan to run fast in order to maintain proper internal computer temperatures. If needed, quit application or restart computer to resolve issue.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Disconnect any peripheral devices, cards, or cables attached to computer.  Has the noise been eliminated?	Yes	Issue resolved. Issue caused by ground loop induced by third-party devices. Advise user to connect all devices to a common power outlet or contact device manufacturer for support.		
		No	Go to step 2.		
2.	Tilt display to hinge limits to determine whether mechanical noise is generated by hinge mechanism.  Is the noise coming from iMac's display hinge?	Yes	Go to "Stand/Hinge Issues" troubleshooting flow.		
		No	Go to step 3.		
3.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.  Remove LCD panel with glass.  Connect computer to AC power and listen carefully around power supply to verify whether it is source of noise.  <b>Warning: HIGH VOLTAGE: The power supply remains energized whenever the computer is plugged in, whether or not the computer has been turned on. Use extreme caution when troubleshooting with the display panel removed.</b>  Is noise coming from iMac's power supply?	Yes	Replace power supply. Verify issue resolved.	P04	POWER SUPPLY
		No	Go to step 4.		
4.	Shut down computer. If you reinstalled LCD panel with glass, remove it.  Hold computer firmly with both hands and invert computer while gently shaking it, to attempt to dislodge and remove any loose screws or other foreign objects that may have fallen down inside the computer into the chin area.  Loose objects in the chin area can cause noise or vibration, especially during audio playback.  Briefly retest for noise, hum, or vibration.  Has noise been eliminated?	Yes	Issue resolved by removing loose objects inside chin area.		
		No	Go to step 5.		
5.	Shut down computer and let it cool off fully. Check for noise, hum or vibration during startup when computer is cold.  Does issue happen on or after a cold startup?	Yes	Go to step 6.		
		No	Go to step 12.		

	Check	Result	Action	Code	Commodity
6.	An unreadable thermal sensor can cause fan to run excessively. Run Mac Resource Inspector (MRI) to check thermal sensors.	Yes	Go to “Computer Runs Hot” troubleshooting flow.		
	Does MRI report any thermal sensor failures?	No	Go to step 7.		
7.	Excessive fan operation may also occur if computer is unable to read fan speed. Check MRI results for fan (motor) sensor test results.	Yes	Go to step 8.		
	Does MRI report any fan (motor) failures?	No	Go to step 10.		
8.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 9.		
	Do you have immediate access to known-good fan?	No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
9.	Substitute known-good fan and retest with MRI.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Does known-good fan pass fan (motor) test in MRI?	No	Reinstall user's fan. Replace the logic board. Verify issue resolved.	M23	MLB
10.	Disconnect fan and briefly retest for noise, hum or vibration.	Yes	Go to step 11.		
	Has noise been eliminated?	No	Go to step 12.		
11.	Verify whether any tape, gasket, cable label, cable, or other material is touching fan blades and causing a ticking or buzzing noise. Secure material so it does not touch fan blades. If tape adhesive has lost its stickiness, replace that section of tape.	Yes	Issue resolved by securing internal components or material to prevent touching fan blades. Verify resolution.		
	Remove fan and rotate blades. Verify that fan blades spin smoothly without interference from fan housing, cables, tape, gaskets or other components.  Reinstall fan while carefully ensuring that there are no cables routed under or near fan assembly that might cause interference with fan blades. After reassembling computer, verify whether noise issue is resolved.  Has noise been eliminated?	No	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
12.	Depending on configuration, there may or may not be a hard drive installed. Other configurations may have either a flash storage card or both flash storage and HDD.	Yes	Go to step 13.		
	Is a hard drive installed in computer?	No	Go to step 14.		
13.	Remove internal hard drive and start up computer from recovery partition or an up-to-date, bootable OS X volume.	Yes	Go to “HDD Noisy” troubleshooting flow.		
	Has noise been eliminated?	No	Go to step 14.		

	Check	Result	Action	Code	Commodity
14.	Play sound sample at loud and soft volume levels to determine whether noise is caused by left/right speakers or amplifier circuit. Plug in external headphones to identify whether noise comes from audio out or from other source. Mute computer volume. Verify whether issue still occurs.  Has noise been eliminated?	Yes	Go to "Distorted Audio from Internal Speaker(s)" troubleshooting flow.		
		No	Go to step 15.		
15.	To troubleshoot this issue completely, a known-good fan is required.  Do you have immediate access to a known-good fan?	Yes	Go to step 16.		
		No	Go to step 17.		
16.	Substitute known-good fan and retest.	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
	Has noise been eliminated?	No	Go to step 18.		
17.	Disconnect fan and briefly retest for noise, hum, or vibration.  Has noise been eliminated?	Yes	Replace fan. Verify issue resolved.	X23	OTHER ELECTRIC
		No	Go to step 18.		
18.	With hard drive and fan disconnected, briefly retest once again while listening closely for any noise, hum, or vibration coming from logic board and heat sink assembly.  Inspect logic board and heat sink assembly for any damage that may have occurred during removal or replacement.  Logic board and heat sink assembly must be treated as a single unit during removal or replacement. All screws must be removed from both components prior to physically pulling or pushing either component.  Any mishandling of heat sink assembly that is attached to logic board can cause damage to heat pipes connecting these components.  If heat pipes become even slightly damaged (e.g. bent, kinked, etc.), normal heat removal cycle can become disrupted, causing a repetitive hammering noise from this area. Damage may not be visibly noticeable.  Noise may be mistaken for a faulty hard drive. Check for this noise with hard drive and fan disconnected.  Is there noise coming from logic board and heat sink assembly?	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 19.		

	Check	Result	Action	Code	Commodity
19.	<p>Noise may be related to interference from other electrical devices operating near computer or plugged into same power outlet. See whether noise is eliminated when computer runs in a different location on a different circuit.</p> <p>Has noise been eliminated?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Stand/Hinge Issues


## Unlikely causes:



There are no unlikely causes for this issue.


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>Bent stand</li><li>Broken hinge</li><li>Stripped screw/head</li><li>Stripped screw boss/threads</li><li>Loose stand and/or hinge</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>Inspect computer and discuss nature of issue with user. Determine whether user wants to proceed with repair (despite possible accidental damage) or pursue other service options.</li><li>Click "No" to proceed with further troubleshooting.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li><a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li><a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li><a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Determine cause of damage or defects: user/technician, environment, accidental damage, or abuse.	Yes	 <b>ESCALATION REQUIRED.</b> Contact TCS for assistance with Apple-related accidental damage.	X99	
	Is an Apple agent responsible for damage or defect on the computer?	No	Go to step 2.		

	Check	Result	Action	Code	Commodity
2.	<p>Inspect stand to determine whether it requires replacement.</p> <p>Verify that stand securely holds computer in its upright position without wobbling when placed on a hard, smooth, even surface.</p> <p>Is stand damaged or defective?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Replace stand. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	Go to step 3.		
3.	<p>Inspect hinge mechanism to determine whether it requires replacement.</p> <p>Adjust computer back and forth on its hinge, listening for hinge noise. Check feel of the hinge. Its movement should feel firm—not tight or loose—as it holds the iMac in position. Hinge should operate smoothly along its entire travel.</p> <p>Is hinge mechanism damaged or defective?</p>	Yes	<p>Replace hinge mechanism. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p>	X12	PIECE PART
		No	Go to step 4.		
4.	<p>Place the customer's iMac on a solid, flat surface.</p> <p>Have another person apply downward pressure to the stand to hold it down on that solid surface.</p> <p>Firmly grasp both sides of the iMac enclosure, and gently attempt to rotate the entire enclosure left and right while facing the display. The enclosure should not be able to move in this direction.</p> <p>Compare this behavior with a known-good, similar iMac model.</p> <p>If the enclosure rotates an abnormal amount, the mechanism mounts inside the rear enclosure may no longer be securely attached, which may require a rear enclosure replacement.</p> <p>Does the iMac's enclosure rotate an abnormal amount?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Replace the rear housing. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	Go to step 5.		

	Check	Result	Action	Code	Commodity
5.	Verify that both stand and hinge operate properly and that they securely hold the iMac upright in all appropriate positions.  Is issue resolved?	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Intermittent Shutdown

## Unlikely causes:


Battery, camera, camera/microphone/ALS cable, DisplayPort cable, left speaker, memory, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antennas, wireless card


## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Shuts down during startup</li><li>• Shuts down unexpectedly during use</li><li>• Computer restarts spontaneously</li><li>• Powers off when waking from sleep</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Collect details from user regarding shutdown occurrence and system configuration: when shutdown occurs (for example, after running for a while); frequency of shutdowns; which applications are running; and shutdown repeatability.</li><li>2. Make sure that power cord is securely attached to back of computer, and is not hindered by a desk or other furniture.</li><li>3. Plug computer directly into an AC outlet rather than into a surge protector or UPS.</li><li>4. Open System Preferences &gt; Energy Saver &gt; Schedule and make sure that a shut down event is not scheduled.</li><li>5. Use OS X Recovery to troubleshoot potential software issues. Hold down Command (⌘) during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</li><li>6. Hold Shift key during startup to put computer into Safe Mode. See Apple Support article <a href="#">HT1564: OS X: What is Safe Boot, Safe Mode?</a></li><li>7. Run Mac Resource Inspector (MRI) to check fan (motor) speed and thermal/voltage/current sensor detection and values.</li><li>8. Reset SMC using the procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>.</li><li>9. Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear the startup sound for the second time.</li><li>10. If the iMac is internally equipped with both a hard disk drive (HDD) and a solid-state drive (SSD), refer to Apple Support article <a href="#">HT5446: About Fusion Drive</a> for specific troubleshooting and restore processes.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside a computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive

	Check	Result	Action	Code	Commodity
1.	Run diagnostics or Macintosh Resource Inspector (MRI) and consult MRI logs to check for fan (motor) or sensor failures.	Yes	Go to step 2.		
	Sensor(s) that indicate they are out of normal operating range or an inoperative fan can cause intermittent shutdowns.	No	Go to step 6.		
	Did diagnostics/MRI report any fan or sensor failures?				
2.	MRI may report a voltage out of range error, either over- or under-voltage, from the power supply. This out-of-range voltage issue with power supply can cause intermittent shutdowns.	Yes	Go to step 3.		
	iMac power supply related sensor names are:  <u>Sensor - MRI Sensor Name</u> <b>Voltage (VDPr)</b> - Primary AC/DC <b>Voltage (VDSR)</b> - Secondary AC/DC <b>Voltage (VD0R)</b> - 12V S0 <b>Voltage (VD2R)</b> - Power Supply 12V S0	No	Go to step 11.		
	Any one of the above sensors being out of range is typically related to power supply or incoming AC power.				
	Did MRI report failure of a power supply sensor listed above?				
3.	Remove AC power and wait for power supply to discharge. Open computer. Inspect and reseal DC power cable while looking for cable pinch, wire exposure, or connector damage. Also inspect power supply and logic board connectors for damaged housing, and bent or burnt pins.	Yes	Go to step 4.		
	Did you find any damaged components?	No	Go to step 5.		

	Check	Result	Action	Code	Commodity
4.	<p>Identify whether DC power cable is the only damaged component. Damage to multiple parts will require an escalation to TCS.</p> <p>Is damaged limited to DC power cable only?</p>	Yes	Replace DC power cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple part repair.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
5.	<p>After reseating DC power cable, use an external monitor or connect LCD panel to rerun MRI and verify if power supply voltage sensor still gives an error.</p> <p>iMac power supply related sensor names are:</p> <p>Sensor - MRI Sensor Name  <b>Voltage (VDPr)</b> - Primary AC/DC  <b>Voltage (VDSR)</b> - Secondary AC/DC  Voltage (VD0R) - 12V S0  <b>Voltage (VD2R)</b> - Power Supply 12V S0</p> <p>Did MRI report failure of a power supply sensor listed above?</p>	Yes	Replace power supply. Verify issue resolved.	P02	POWER SUPPLY
		No	Go to step 6.		
6.	<p>Start up from internal drive and attempt to reproduce shutdown symptom(s).</p> <p>Can you reproduce shutdown event?</p>	Yes	Go to step 7.		
		No	Go to step 8.		

	Check	Result	Action	Code	Commodity
7.	Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a> .	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for assistance troubleshooting Previous Shutdown Causes.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
	Does shutdown issue persist?	No	Repair disk directory using Disk Utility. If the issue persists after repair, refer to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> , and install the correct OS X version and build on user's hard drive. Check for and apply latest software and firmware updates. Verify issue resolved.		
8.	Run diagnostics in OS loop mode for 8-10 hours, then verify whether computer unexpectedly shut down.	Yes	Go to step 9.		
	Did computer shutdown unexpectedly?	No	No failure found when looping diagnostics tests. Using correct positioning, return computer to user with no trouble found. Verify issue resolved.		
9.	Check diagnostic logs to see whether diagnostics is conducting the same test each time computer unexpectedly shuts down.	Yes	Go to step 10.		
	Does computer consistently shut down during the same diagnostics test?	No	Replace logic board. Verify issue resolved.	M23	MLB


	Check	Result	Action	Code	Commodity
10.	<p>Rerun diagnostics loop tests until computer unexpectedly shuts down, then immediately run MRI to see whether a sensor error is found while computer is still hot. Verify whether MRI (or MRI log on AST server) reports any sensor test failures.</p> <p>Does MRI report any sensor test failures?</p>	Yes	Go to step 11.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for assistance troubleshooting Previous Shutdown Causes.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
11.	<p>Determine specific type of failure reported in diagnostics: thermal/fan sensor or voltage/current sensor.</p> <ul style="list-style-type: none"> <li>• MRI thermal sensors begin with Txxx.</li> <li>• MRI electrical voltage sensors begin with Vxxx.</li> <li>• MRI electrical current sensors begin with Ixxx.</li> </ul> <p>Which sensor failure does diagnostics report?</p>	Voltage/Current Sensor	Replace logic board. Verify issue resolved.	M23	MLB
		Thermal/Fan Sensor	Go to step 12.		
12.	<p>Identify specific type of failure reported in MRI/diagnostics: thermal sensor or fan (motor) error.</p> <p>MRI thermal sensors begin with Txxx.</p> <p>Which sensor failure does diagnostics report?</p>	Fan (Motor)	Go to step 13.		
		Thermal	Go to step 18.		




	Check	Result	Action	Code	Commodity
13.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014) and iMac (27-inch, Late 2012, Late 2013) computers have a single fan. Locate fan and inspect fan cable and connector for damage, and make sure fan blades are not obstructed.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Is fan damaged or blocked?</p>	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
		No	Go to step 14.		
14.	<p>Inspect fan cable connectors on logic board for damaged pins, and missing or broken connector housing.</p> <p>Is logic board damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 15.		
15.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reseat fan cable connector to logic board and retest using MRI/diagnostics.</p> <p>Does diagnostics still report a fan error?</p>	Yes	Go to step 16.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Verify issue resolved.		
16.	<p>To troubleshoot this issue completely, a known-good fan is required.</p> <p>Do you have immediate access to a known-good fan?</p>	Yes	Go to step 17.		
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
17.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove the power cord and wait two minutes for self discharge to occur.</p> <p>Substitute a known-good fan and retest using MRI/diagnostics.</p> <p>Does diagnostics still report a fan error?</p>	Yes	Replace logic board. Reinstall user's fan. Verify issue resolved.	M18	MLB
		No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC

	Check	Result	Action	Code	Commodity
18.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Remove fan. Inspect fan and inner heat sink fin stack of CPU for obstructions. Clean and remove any obstructions or debris. Reinstall fan and retest with MRI/diagnostics.</p> <p>MRI thermal sensors begin with Txxx.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Does diagnostics still report a thermal sensor error?</p>	Yes	Go to step 19.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Verify issue resolved.		
19.	<p>LCD thermal sensor failure alone can cause an unexpected shutdown. It may also affect logic board thermal sensors that are connected in parallel on logic board.</p> <p>LCD thermal sensor name:</p> <p><u>Sensor - MRI Sensor Name</u>  <b>Temperature (TL0p)</b> - LCD proximity  <b>Temperature (TL1p)</b> - TCON proximity</p> <p>Does diagnostics report an LCD thermal sensor error (TL0p/TL1)?</p>	Yes	Go to step 20.		
		No	Go to step 28.		
20.	<p>The <b>TL0p</b> sensor is attached on back of the LCD panel, while the <b>TL1p</b> sensor is part of LCD logic board. Identify which one of these sensors report an error when running diagnostics.</p> <p>Does diagnostics report a TL0p or TL1p sensor error?</p>	TL0p	Go to step 21.		
		TL1p	Replace LCD panel with glass. Verify issue resolved.	L85	LCD


	Check	Result	Action	Code	Commodity
21.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Inspect thermal sensor, cable, and connector, for damage.</p> <p><b>TL0p</b> LCD thermal sensor is attached with tape to rear of LCD panel with glass with a short, thin cable. This sensor does not connect to logic board. It connects to a thermal sensor board mounted on LCD panel.</p> <p>LCD thermal sensor signals are encoded on this board (which is part of the LCD panel), and this information is sent to logic board through DisplayPort cable.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 27.		
		No	Go to step 22.		
22.	<p>Reseat LCD thermal sensor cable to thermal sensor board mounted on LCD and reseat DisplayPort connector on logic board. Retest using diagnostics.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Does diagnostics still report an LCD thermal sensor error (TL0p)?</p>	Yes	Go to step 23.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Verify issue resolved.		
23.	<p>To troubleshoot this issue completely, a known-good LCD thermal sensor cable is required.</p> <p><b>Note:</b> LCD thermal sensor cable is available separately. A replacement LCD panel with glass also comes with a new LCD thermal sensor cable already attached.</p> <p>Do you have immediate access to a known-good LCD thermal sensor cable?</p>	Yes	Go to step 24.		
		No	Replace LCD thermal sensor cable. Verify issue resolved.	X03	INTERNAL CABLE
24.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good LCD thermal sensor cable and retest using diagnostics.</p> <p>Does diagnostics still report an LCD thermal sensor error (TL0p)?</p>	Yes	Go to step 25.		
		No	Replace LCD thermal sensor cable. Verify issue resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
25.	<p>To troubleshoot this issue completely, a known-good LCD panel with glass is required.</p> <p><b>Note:</b> LCD thermal sensor cable is available separately. A replacement LCD panel with glass also comes with a new LCD thermal sensor cable already attached.</p> <p>Do you have immediate access to a known-good LCD panel with glass?</p>	Yes	Go to step 26.		
		No	Replace LCD panel with glass. Verify issue resolved.	L85	LCD
26.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good LCD panel with glass, and retest using diagnostics.</p> <p>Does diagnostics still report an LCD thermal sensor error (TL0p)?</p>	Yes	Replace logic board. Reinstall user's LCD thermal sensor cable. Verify issue resolved.	M23	MLB
		No	Replace LCD panel with glass. Verify issue resolved.	L85	LCD
27.	<p>Identify whether LCD thermal sensor cable is the only damaged component. Damage to multiple parts will require an escalation to TCS.</p> <p>Is damaged limited to LCD thermal sensor cable only?</p>	Yes	Replace LCD thermal sensor cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
28.	<p>Hard drive thermal sensor failure alone can cause an unexpected shutdown. It can also affect logic board thermal sensors that are connected in parallel on logic board.</p> <p>Hard drive thermal sensor names:</p> <p><u>Sensor - MRI Sensor Name</u>  <b>TH00</b> - Hard drive proximity  <b>TH0o</b> - Hard drive Out of Band</p> <p>Does diagnostics report a hard drive thermal sensor error (TH0o/TH0O)?</p>	Yes	Go to step 29.		
		No	Go to step 36.		



	Check	Result	Action	Code	Commodity
29.	<p>Newer iMacs have a thermal sensor built-in to the hard drive. Third-party hard drives may not have this sensor present and should flag a TH0o error. If user's hard drive is third-party, you may wish to explain to user that repair should continue with a known-good Apple hard drive.</p> <p>Is a third-party hard drive installed?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
		No	Go to step 30.		
30.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>The thermal sensor internal to the hard drive is wired through hard drive data cable to logic board. Inspect hard drive data cable, hard drive connector, and logic board connector for damage.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 35.		
		No	Go to step 31.		
31.	<p>Reseat hard drive data cable to both hard drive and logic board, then retest using diagnostics.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Does diagnostics still report a hard drive thermal sensor error (TH0o/TH0O)?</p>	Yes	Go to step 32.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Verify issue resolved.		
32.	<p>To troubleshoot this issue completely, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• Hard drive</li> <li>• Hard drive data cable</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 33.		
		No	Replace hard drive data cable. Verify issue resolved.	X03	INTERNAL CABLE

	Check	Result	Action	Code	Commodity
33.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive data cable and retest using diagnostics.</p> <p>Does diagnostics still report a hard drive thermal sensor error (TH0o/TH0O)?</p>	Yes	Go to step 34.		
		No	Replace hard drive data cable. Verify issue resolved.	X03	INTERNAL CABLE
34.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive and retest using diagnostics.</p> <p>Does diagnostics still report a hard drive thermal sensor error (TH0o/TH0O)?</p>	Yes	Replace logic board. Reinstall user's hard drive and hard drive data cable. Verify issue resolved.	M23	MLB
		No	Replace hard drive. Reinstall user's hard drive data cable. Verify issue resolved.	H85	HDD
35.	<p>Identify whether hard drive data cable is the only damaged component. Damage to multiple parts will require an escalation to TCS.</p> <p>Is damaged limited to hard drive data cable only?</p>	Yes	Replace hard drive data cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
36.	<p>iMacs with a solid state drive (SSD)/flash storage card have a thermal sensor built-into the SSD/flash storage card.</p> <p>SSD/flash storage thermal sensor name:</p> <p><u>Sensor - MRI Sensor Name</u> <b>TH1R</b> - SSD Out of band</p> <p>Does diagnostics report an SSD/flash storage thermal sensor error (TH1R)?</p>	Yes	Go to step 37.		
		No	Go to step 42.		

	Check	Result	Action	Code	Commodity
37.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>The thermal sensor internal to the SSD/flash storage is wired through the data connection to the logic board. Inspect SSD/flash storage card data connector and logic board connector for damage.</p> <p>Did you find any damaged components?</p>	Yes	Go to step 41.		
		No	Go to step 38.		
38.	<p>Reseat SSD/flash storage card to logic board, then retest using diagnostics.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Does diagnostics still report an SSD/flash storage thermal sensor error (TH1R)?</p>	Yes	Go to step 39.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Verify issue resolved.		
39.	<p>To troubleshoot this issue completely, a known-good SSD/flash storage card is required.</p> <p>Do you have immediate access to a known-good SSD/flash storage card?</p>	Yes	Go to step 40.		
		No	Replace SSD/flash storage card. Verify issue resolved.	H85	SSD
40.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good SSD/flash storage card and retest using diagnostics.</p> <p>Does diagnostics still report an SSD/flash storage thermal sensor error (TH1R)?</p>	Yes	Replace logic board. Reinstall user's SSD/flash storage card. Verify issue resolved.	M23	MLB
		No	Replace SSD/flash storage card. Verify issue resolved.	H85	SSD

	Check	Result	Action	Code	Commodity
41.	<p>Identify whether SSD/flash storage card connector is the only damaged component. Damage to multiple parts will require an escalation to TCS.</p> <p>Is damaged limited to SSD/flash storage card only?</p>	Yes	Replace SSD/flash storage card. Verify issue resolved.	H85	SSD
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
42.	<p>Ambient thermal sensor failure alone can cause an unexpected shutdown. This sensor monitors incoming airflow to properly cool CPU.</p> <p>Ambient thermal sensor name:</p> <p><u>Sensor - MRI Sensor Name</u> <b>TA0p</b> - Ambient MLB</p> <p>Does diagnostics report an ambient thermal sensor error (TA0p)?</p>	Yes	Replace logic board. Verify issue resolved.	M23	MLB
		No	Go to step 43.		
43.	<p>We have exhausted all external thermal sensors other than those on logic board.</p> <p>MRI thermal sensor names:</p> <p><u>Sensor - MRI Sensor Name</u>  <b>TCXr</b> - CPU die  <b>TC0p</b> - CPU Proximity  <b>TG0d</b> - GPU die  <b>TG0p</b> - GPU Proximity  <b>TPCD</b> - PCH die  <b>TM0p - TM1P-TM2P- TM3p</b> - SO-DIMM Proximity  <b>Tm0p - Tm1p-Tm2p</b> - Misc. MLB Proximity  <b>Tb0p</b> - BLC Proximity</p> <p>Does diagnostics report any of the above thermal sensors as failing?</p>	Yes	Replace logic board. Verify issue resolved.	M23	MLB
		No	Go to step 44.		



	Check	Result	Action	Code	Commodity
44.	<p>Power supply thermal sensor failures can cause an unexpected shutdown. This sensor monitors the power supply secondary heat sink temperature.</p> <p>Power supply thermal sensor name:</p> <p><u>Sensor - MRI Sensor Name</u> <b>TP2h</b> - AC/DC Secondary heat sink</p> <p>Does diagnostics report an power supply thermal sensor error (TP2h)?</p>	Yes	Replace power supply. Verify issue resolved.	P02	MLB
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
45.	<p>Run diagnostics in OS loop mode for 8-10 hours to verify that computer does not unexpectedly shut down.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Kernel Panic/System Crashes


## Unlikely causes:

Battery, DisplayPort cable, HDD power cable, LCD panel with glass, left speaker, power supply, rear enclosure, right speaker, stand, Wi-Fi/Bluetooth antenna(s)

## Quick Check


Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Computer displays a kernel panic alert message (see Apple Support article <a href="#">PH14063: OS X Mavericks: If your Mac restarts and a message appears</a>)</li><li>• Computer freezes during use</li><li>• Computer freezes upon wake from sleep</li><li>• Computer freezes when Wi-Fi is enabled or activated</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Check for and apply latest software and firmware updates. Remember that third party software can contribute to this issue. It may be necessary to check for and apply third party updates that may not appear in the App store.</li><li>2. Remove all external devices, except for a known-good USB keyboard and mouse, to help rule out peripherals as a possible cause of this issue.</li><li>3. Verify memory configuration matches actual amount of installed physical memory.</li><li>4. Hold Shift key during startup to put computer into Safe Mode. See Apple Support article <a href="#">HT1564: Mac OS X: What is Safe Boot, Safe Mode?</a></li><li>5. Use OS X Recovery to troubleshoot potential software issues. Hold down Command (⌘) + R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</li><li>6. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer.</li><li>7. Follow steps outlined in Apple Support article <a href="#">TS3742: OS X: About kernel panics</a>.</li><li>8. If issue cannot be easily reproduced, loop diagnostics or OS tests.</li><li>9. If the iMac is internally equipped with both a hard drive and a solid state drive (SSD), refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore processes.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer when power is applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>


## Deep Dive

	Check	Result	Action	Code	Commodity
1.	A voltage, current, or thermal sensor failure or an inoperative fan can cause kernel panics or system crashes. Run Macintosh Resource Inspector (MRI) or consult MRI logs to check for any sensor or fan failures.  Does MRI report any sensor or fan failures?	Yes	Go to “Intermittent Shutdown” troubleshooting flow.		
		No	Go to step 2.		
2.	Reset SMC using the procedure for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a> .  Then reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time.  Does computer still experience crashes or kernel panics?	Yes	Go to step 3.		
		No	Issue resolved by SMC/PRAM reset. Verify resolution.  This issue could reoccur if the cause is one of the user's external devices that was not brought in with the computer.  Advise user to verify computer is functioning properly by initially leaving all external devices detached, then connecting them one at a time to confirm each device's functionality.  If this issue reoccurs, the user should document which external devices are attached and bring them with the computer.		
3.	Ask user which USB device(s) are used with computer when crashes or kernel panics occur.  Does user have a USB device that may be causing crashes or kernel panics?	Yes	Go to step 4.		
		No	Go to step 5.		
4.	Connect a known-good wired Apple aluminum USB keyboard and wired mouse to user's computer. Disconnect user's USB device(s). Test computer with OS or diagnostics.  Does computer still experience crashes or kernel panics?	Yes	Go to step 5.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Refer to Apple Support article <a href="#">HT1151: USB and FireWire Quick Assist</a> for help with USB devices and USB third-party product support. Contact TCS for additional support and latest USB device information.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
5.	Connect a known-good Apple wired keyboard and Apple wired mouse to user's computer.	Yes	Go to step 6.		
	<p>Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition.</p> <p>If the iMac is internally equipped with both a hard disc drive (HDD) and solid-state drive (SSD)/flash storage, refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore processes.</p> <p>Does computer still experience crashes or kernel panics?</p>	No	Go to step 28.		
6.	Hold Shift key during startup to put computer into Safe Mode. See Apple Support article <a href="#">HT1564: Mac OS X: What is Safe Boot, Safe Mode?</a>	Yes	Go to step 7.		
	Does computer still experience crashes or kernel panics?	No	Go to step 11.		
7.	On some models the memory is non-serviceable and can not be removed from the MLB.	Yes	Go to step 9.		
	Is the memory removable from the system?	No	Go to step 8.		
8.	Check to see if diagnostic LED #3 is illuminated.	Yes	Go to step 11.		
	<p><b>Note:</b> Depending on computer model, this may simply require looking through the bottom air flow opening or removing the LCD.</p> <p>Is diagnostic LED #3 illuminated?</p>	No	Replace logic board. Verify issue resolved.	M06	MLB
9.	Remove installed memory modules and substitute one by one with a known-good memory module.	Yes	Go to step 10.		
	<p><b>Note:</b> Depending on computer model, this may simply require removal of the rear door, or the removal of LCD display and logic board to access the memory modules.</p> <p>Does computer still experience crashes or kernel panics?</p>	No	<p>Isolate and replace memory module.</p> <p><b>Note:</b> Only replace a defective memory module. There is no need to replace memory in pairs.</p> <p>Verify issue resolved.</p>	X01	MEMORY

	Check	Result	Action	Code	Commodity
10.	Check logic board memory slots one by one, using a known-good memory module, to isolate a slot-related failure and retest.	Yes	Replace logic board. Reinstall user's memory. Verify issue resolved.		
	<p><b>Note:</b> Connecting an external display will permit retesting without reinstalling the internal LCD panel.</p> <p>Does crash or kernel panic occur when memory is installed in a specific slot?</p>	No	Go to step 11.		
11.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove wireless card and retest by testing computer with OS or diagnostics. Connect power cord to computer, wait five seconds for SMC to reset, then press power button.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014) Safety</a></li> </ul> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 17.		
		No	Go to step 12.		
12.	Inspect wireless card and logic board connectors for damage.	Yes	Go to step 16.		
	Did you find any damaged components?	No	Go to step 13.		
13.	Reseat wireless card to logic board and retest with OS or diagnostics.	Yes	Go to step 14.		
	Does computer still experience crashes or kernel panics?	No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly shut down. Issue resolved.		
14.	To troubleshoot this issue completely, a known-good wireless card is required.	Yes	Go to step 15.		
	Do you have immediate access to a known-good wireless card?	No	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE


	Check	Result	Action	Code	Commodity
15.	Substitute a known-good wireless card and retest computer with OS or diagnostics.	Yes	Replace logic board. Reinstall user's wireless card. Verify issue resolved.	M06	MLB
	Does computer still experience crashes or kernel panics?	No	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
16.	Identify whether wireless card is the only damaged component. Damage to multiple parts will require an escalation to TCS.  Is damaged limited to wireless card only?	Yes	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
17.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Disconnect camera/microphone/ALS cable from either logic board or camera and retest computer with OS or diagnostics.  Does computer still experience crashes or kernel panics?	Yes	Go to step 25.		
		No	Go to step 18.		
18.	Inspect camera, camera/microphone/ALS cable, and logic board connector for damage.  Did you find any damaged components?	Yes	Go to step 24.		
		No	Go to step 19.		
19.	Reseat both ends of camera/microphone/ALS cable and retest computer with OS or diagnostics.  Does computer still experience crashes or kernel panics?	Yes	Go to step 20.		
		No	Run diagnostics in OS loop mode to verify that computer does not unexpectedly crash or kernel panic. Issue resolved.		
20.	To troubleshoot this issue completely, a known-good camera/microphone/ALS cable is required.  Do you have immediate access to a known-good camera/microphone/ALS cable?	Yes	Go to step 21.		
		No	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE


	Check	Result	Action	Code	Commodity
21.	Substitute a known-good camera/microphone/ALS cable and retest computer with OS or diagnostics.  Does computer still experience crashes or kernel panics?	Yes	Go to step 22.		
		No	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
22.	To troubleshoot this issue completely, a known-good camera is required.  Do you have immediate access to a known-good camera?	Yes	Go to step 23.		
		No	Replace camera. Reinstall user's camera/microphone/ALS cable. Verify issue resolved.	X11	OTHER ELECTRIC
23.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Substitute a known-good camera and retest computer with OS or diagnostics.  Does computer still experience crashes or kernel panics?	Yes	Replace logic board. Reinstall user's camera and camera/microphone/ALS cable. Verify issue resolved.	M06	MLB
		No	Replace camera. Reinstall user's camera/microphone/ALS cable. Verify issue resolved.	X11	OTHER ELECTRIC
24.	Identify whether camera/microphone/ALS cable is the only damaged component. Damage to multiple parts will require an escalation to TCS.  Is damaged limited to camera/microphone/ALS cable only?	Yes	Replace camera/microphone/ALS cable. Verify issue resolved.	X03	INTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	



	Check	Result	Action	Code	Commodity
25.	<p>Mac models may have a hard drive, solid-state drive (SSD)/flash storage, or both. If the iMac is internally equipped with both, refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore processes.</p> <p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Disconnect hard drive data cable (or SSD/ flash storage) from logic board. Connect an Ethernet cable and power cord to computer, wait five seconds for SMC to reset, then press power button. Hold down Command-Option-R keys during startup to force restart from OS X Internet recovery.</p> <p>This process may take a few minutes for computer to completely start up, depending on speed of your Internet connection. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a> for more information.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 36.		
		No	Go to step 26.		
26.	<p>Mac models may have a hard drive, solid-state drive (SSD)/flash storage, or both. If the iMac is internally equipped with both, refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore processes. To support Fusion Drive functionality, a known-good HDD and SSD/flash storage should be used.</p> <p>To completely troubleshoot this issue, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• Hard drive or SSD/flash storage</li> <li>• Hard drive data cable</li> </ul> <p>For a Fusion Drive computer, the following known-good parts are required:</p> <ul style="list-style-type: none"> <li>• Hard drive and paired SSD/flash storage</li> <li>• Hard drive data cable</li> </ul> <p>Do you have immediate access to each of these known-good parts?</p>	Yes	Go to step 30.		
		No	Go to step 27.		



	Check	Result	Action	Code	Commodity
27.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Reconnect hard drive data cable (or SSD/ flash storage) to logic board.</p> <p>Hold down Command-R during startup to restart from the recovery partition and use Disk Utility to repair user's hard drive or SSD/flash storage. If disk repair is successful, restart and test user's OS.</p> <p>Was Disk Utility repair successful and is crash/kernel panic issue resolved?</p>	Yes	Issue resolved after Disk Utility repair. Verify resolution.		
		No	Go to step 28.		
28.	<p>Restore OS X on user's hard drive or SSD/flash storage. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 29.		
		No	Issue resolved after reinstalling OS X. Verify resolution.		
29.	<p>Identify the type of storage device affected:</p> <ul style="list-style-type: none"> <li>• Hard disk drive (HDD)</li> <li>• Flash storage/solid-state drive (SSD)</li> </ul> <p>Is the affected device an HDD or SSD?</p>	HDD	Replace the user's hard drive. Verify issue resolved.	H02	HDD
		SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H02	SSD
30.	<p>iMacs equipped with both a hard disc drive (HDD) and solid-state drive (SSD)/flash storage ship as a Fusion Drive configuration. Refer to Apple Support article <a href="#">HT5446: Mac mini (Late 2012), iMac (Late 2012 and later): About Fusion Drive</a> for specific troubleshooting and restore processes.</p> <p>Is computer configured as a Fusion Drive?</p>	Yes	Go to step 35.		
		No	Go to step 31.		
31.	<p>iMac may be equipped with either a hard drive or SSD/flash storage. Identify which type of storage device is installed.</p> <p>Is computer equipped with a hard drive or with a SSD/flash storage card?</p>	Hard Drive	Go to step 33.		
		SSD/Flash Storage	Go to step 32.		

	Check	Result	Action	Code	Commodity
32.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute known-good SSD/flash storage with an up-to-date, bootable version of OS X installed. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Replace logic board. Reinstall user's SSD/flash storage. Verify issue resolved.	M06	MLB
		No	Replace user's SSD/flash storage. Verify issue resolved.	H02	SSD
33.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive with an up-to-date, bootable version of OS X installed. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 34.		
		No	Replace user's hard drive. Verify issue resolved.	H02	HDD
34.	<p>Continue using known-good hard drive. Substitute a known-good hard drive data cable between drive and logic board, and retest computer with OS.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Replace logic board. Reinstall user's hard drive (or/and SSD/flash storage) and data cable. Verify issue resolved.	M06	MLB
		No	Replace hard drive data cable. Reinstall user's hard drive. Verify issue resolved.	X03	OTHER ELECTRIC
35.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Substitute a known-good hard drive and SSD/flash storage paired as a Fusion Drive with an up-to-date, bootable version of OS X installed. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</p> <p>Does computer still experience crashes or kernel panics?</p>	Yes	Go to step 34.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

	Check	Result	Action	Code	Commodity
36.	Restart computer from Apple Service Toolkit (AST) server by pressing N key on startup.  Use extended version of Cooling System Diagnostics (CSD) to verify proper function of the following subsystems: <ul style="list-style-type: none"><li>• SMC</li><li>• Fan</li><li>• Thermal sensors</li><li>• CPU–heat sink thermal interface</li></ul>	Yes	 <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple-part repair.  Click the Help button in the GSX toolbar, then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	X99	
	Does computer pass all CSD checks?	No	Go to step 37.		
37.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Inspect fan and heat sink fin stack. Partial disassembly of computer is required to access fan and heat sink. Use an ESD-safe vacuum to remove any dust or debris. Reassemble and retest using CSD.	Yes	Issue resolved by cleaning airflow. Verify resolution.		
	Does computer pass all CSD checks?	No	Go to step 38.		
38.	To troubleshoot this issue completely, a known-good fan is required.	Yes	Go to step 39.		
	Do you have immediate access to known-good fan?	No	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
39.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.  Substitute a known-good fan and retest using CSD.	Yes	Replace fan. Verify issue resolved.	X22	OTHER ELECTRIC
	Does computer now pass CSD tests?	No	Go to step 40.		
40.	To troubleshoot this issue completely, a known-good logic board is required.	Yes	Go to step 41.		
	Do you have immediate access to a known-good logic board?	No	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB

	Check	Result	Action	Code	Commodity
41.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Continue to use known-good fan. Substitute a known-good logic board. Reassemble computer and retest with MRI and CSD.</p> <p>Do both known-good fan and logic board pass MRI and CSD tests?</p>	Yes	Reinstall user's fan. Replace logic board. Verify issue resolved.	M18	MLB
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
42.	<p>Run diagnostics in OS loop mode for 8-10 hours to verify that computer does not encounter a crash or kernel panic.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): No Power

## Unlikely causes:


Camera, camera/microphone/ALS cable, CPU fan, DisplayPort cable, hard disk drive (HDD), HDD data cable, HDD power cable, LCD panel with glass, left speaker, memory, right speaker, solid state drive (SSD)/Flash storage card, stand, Wi-Fi/Bluetooth antenna(s), wireless card


## Quick Check

Symptoms	Quick Check
<ul style="list-style-type: none"><li>• Computer does not power on</li><li>• No image on internal or external displays</li><li>• No startup sound</li><li>• No sounds from fan or hard drive (if hard drive present)</li><li>• No Caps Lock LED when key is pressed on wired keyboard</li><li>• Non-operational</li></ul> <p><b>Note:</b> Inform user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"><li>1. Verify AC power source.</li><li>2. Disconnect all peripherals.</li><li>3. Verify user's power cord.</li><li>4. Determine whether computer is in power-on state by checking for all of the following:<ul style="list-style-type: none"><li>◦ Caps Lock LED on wired keyboard</li><li>◦ Fan spinning sound</li><li>◦ Startup sound</li><li>◦ Hard drive spin (if hard drive present)</li><li>◦ Display backlight on</li><li>◦ External display activity</li><li>◦ Thunderbolt disk mode operation</li></ul></li><li>5. Reset SMC using the procedure listed in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a>. Try to power on from power-off state.</li></ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with Power Supply Covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off computer, and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"><li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li><li>• <a href="#">TP820: iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li><li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li></ul>

## Deep Dive


	Check	Result	Action	Code	Commodity
1.	Press power button to start up computer. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound, or Caps Lock LED on wired keyboard.	Yes	Go to step 14.		
		No	Go to step 2.		
	Does computer show any signs of power activity?				

	Check	Result	Action	Code	Commodity
2.	Inspect user's power cord for wire or connector damage. Also inspect computer AC inlet for signs of arcing or damaged pins, which could affect power cord connections.  Did you find any damaged components?	Yes	Go to step 3.		
		No	Go to step 4.		
3.	Determine whether damage affects user's power cord, AC inlet, or both.  Is damage limited to power cord only?	Yes	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
4.	Verify that user's power cord is securely plugged into a known-good, grounded electrical outlet that provides adequate voltage and power to operate computer. Ensure power cord is fully seated to AC inlet. Attempt to power on computer.  Does issue persist after reseating power cord?	Yes	Go to step 5.		
		No	Go to step 14.		
5.	Substitute a known-good power cord and attempt to power on computer.  Does issue persist with known-good power cord?	Yes	Go to step 6.		
		No	Replace user's power cord. Verify issue resolved.	X03	EXTERNAL CABLE

	Check	Result	Action	Code	Commodity
6.	Reset SMC using the procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC).</a>  1. Press and hold power button a little more than 10 seconds to force SMC to power off computer from an unknown power state. 2. Disconnect power cord and wait 15 seconds with power cord removed to reset SMC. 3. Attach computer's power cord, making sure power button is not being pressed. 4. Wait five seconds, then press the power button to turn on computer.  Does issue persist after SMC reset?	Yes	Go to step 7.		
		No	Issue resolved after SMC reset. Verify resolution.		
7.	Remove AC power cord and allow time for power supply to discharge before opening computer for repair.  Remove glass and LCD panel to inspect and reseal:  <ul style="list-style-type: none"> <li>AC inlet power to power supply</li> <li>DC power cable between power supply and logic board</li> <li>Power button cable to power supply</li> </ul> Inspect wires and connectors, looking for pinched or exposed wire, and burnt or damaged connectors and pins.  Did you find any damaged components?	Yes	Go to step 8.		
		No	Go to step 9.		
8.	Determine whether damage affects DC power cable only, or additional components such as power supply or logic board connectors. Multiple damaged parts requiring replacement will be escalated to TCS.  Is damage limited to DC power cable only?	Yes	Replace power supply. Verify issue resolved.	P16	POWER SUPPLY
		No	  <b>ESCALATION REQUIRED.</b>  Contact TCS for additional support or a multiple-part repair.  Click the Help button in the GSX toolbar, then choose Troubleshooting > Technical Help with a Repair > Contact Apple.	P99	


	Check	Result	Action	Code	Commodity
9.	Connect power cord to computer, wait five seconds for SMC to set, then press power button. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound, or Caps Lock LED on wired keyboard.	Yes	Go to step 14.		
	<p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Does computer show any signs of power activity?</p>	No	Go to step 10.		
10.	Locate diagnostic LEDs on logic board. With AC power cord connected to computer, verify whether diagnostic LED #1 is on, indicating power supply is providing power to SMC and logic board.	Yes	Go to step 11.		
	<p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Is diagnostic LED #1 on?</p>	No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY



	Check	Result	Action	Code	Commodity
11.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Disconnect power button cable from power supply to inspect cable and connector for damage. Using a multimeter (set as ohm meter), verify continuity between the two pins of the power button when it is pressed. A properly working power button should be open when button is released.</p> <p>Does power button have continuity when button is pressed and open when released?</p>	Yes	Go to step 12.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Replace the rear housing which includes the power button. Verify issue resolved.</p> <p>Inform user that failures due to accidental damage are not covered by Apple's one-year limited warranty or the AppleCare Protection Plan. Refer to <a href="http://www.apple.com/legal/warranty">www.apple.com/legal/warranty</a>.</p> <p>Contact TCS for additional support regarding warranty coverage for this part.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	
12.	<p>Reconnect power button cable to power supply. Connect power cord to computer, wait five seconds for SMC to become ready, then press power button to start up computer. Verify whether diagnostic LED #2 is on soon after power button is pressed. This indicates that power to start up computer is on.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>Are both diagnostic LED #1 and LED #2 on?</p>	Yes	Go to step 13.		
		No	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
13.	<p>Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound, or Caps Lock LED on wired keyboard.</p> <p>Does computer show any signs of power activity?</p>	Yes	Go to step 14.		
		No	Go to step 16.		
14.	<p>Verify whether a video signal appears on display.</p> <p>Is a video image clearly visible on display?</p>	Yes	Run Mac Resource Inspector (MRI) to obtain latest test results. Verify issue resolved.		
		No	Go to step 15.		

	Check	Result	Action	Code	Commodity
15.	On a display with dim or no backlight, shine a bright flashlight onto front of display while carefully checking for a faint image showing graphics, an Apple logo, open windows, or other signs that the system is partially functional.  Is any video visible with flashlight?	Yes	Go to “Backlight Issue/No Backlight” troubleshooting flow.		
		No	Go to “Power But Blank/No Video” troubleshooting flow.		
16.	To continue to troubleshoot this issue, a known-good power supply is required.  Do you have immediate access to a known-good power supply?	Yes	Go to step 17.		
		No	Go to step 18.		
17.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.  Substitute a known-good power supply and attempt to power on computer.  Does computer show any signs of power activity?	Yes	Replace power supply. Verify issue resolved.	P01	POWER SUPPLY
		No	Go to step 18.		
18.	Measure the logic board coin battery voltage using one of the procedures listed below: <ul style="list-style-type: none"> <li><a href="#">TP911: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Diagnostic LEDs and Test Pads</a></li> <li><a href="#">TP813: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Diagnostic LEDs and Test Pads</a></li> </ul> Carefully touch one multimeter probe to each pad to measure an expected coin battery voltage of 3 volts DC.  If the voltage is 2.7 VDC or less, replace the coin battery.  Is the coin battery voltage low (2.7 VDC or less)?	Yes	Replace coin battery. Verify issue resolved.	P12	OTHER ELECTRIC
		No	Go to step 19.		
	<b>Important:</b> Remove AC power to computer and wait 2 minutes.  Force-reset the logic board Real-Time Clock (RTC) using one of the procedures listed below, and refer to corresponding link for exact location of reset pads for this computer. Be extra careful not to touch any other components to avoid damaging logic board.  <b>Caution:</b> Do not short-circuit the reset pads for more than a few seconds, as doing so may cause damage to coin battery and/or logic board.	Yes	Issue resolved by resetting logic board. Verify resolution.		

19.	<p><b>1. Small flat-blade screwdriver:</b> Gently touch flat edge of the tip of the blade to both pads simultaneously.</p> <p><b>2. Torx T-10 screwdriver:</b> Holding screwdriver vertically, bridge the flat surface of the tip across both reset pads.</p> <p><b>3. Two small metal jeweler's screwdrivers:</b> Touch the tip of each screwdriver to each reset pad, then cross the shanks of the two screwdrivers and touch them together briefly.</p> <ul style="list-style-type: none"> <li>◦ <a href="#">TP911: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Diagnostic LEDs and Test Pads</a></li> <li>◦ <a href="#">TP813: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Diagnostic LEDs and Test Pads</a></li> </ul> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button. Check computer for any signs of power activity, such as fan or hard drive activity (if hard drive present), startup sound, or Caps Lock LED on wired keyboard.</p> <p><b>Caution:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Does computer show any signs of power activity?</p>	No	Replace logic board. Verify issue resolved.	M01	MLB
-----	--	----	---	-----	-----

	Check	Result	Action	Code	Commodity
20.	<p>Verify that computer can now complete startup process over multiple trials.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# **iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Will Not Start Up**

## **Unlikely causes:**

Camera, camera/microphone/ALS cable, fan, DisplayPort cable, left speaker, power supply, rear enclosure, right speaker, stand

## **Quick Check**

Symptoms	Quick Check
<ul style="list-style-type: none"> <li>• No startup sound or POST (Power-On Self-Test)</li> <li>• Gray screen appears during startup</li> <li>• Some video activity, Apple logo, spinning gear</li> <li>• Prohibitory sign or folder with a flashing question mark</li> <li>• Startup chime or error beep tones</li> <li>• Audible fan, hard drive spin (if present) or optical drive reset sounds</li> <li>• Sleep LED on, blinking or went out.</li> <li>• Caps Lock LED on wired keyboard toggles on and off when pressed</li> </ul> <p><b>Note:</b> Inform the user that computer failures due to accidental damage are not covered. If applicable, discuss out-of-warranty repair options.</p>	<ol style="list-style-type: none"> <li>1. Verify that startup process passes initial memory checks and POST (Power-On Self-Test) with a normal startup sound and with some video activity. If computer generates beeping sounds, there may be an issue with memory. See Apple Support article <a href="#">HT2341: Intel-based Mac Power-On Self Test RAM error codes</a>.</li> <li>2. Disconnect all external peripherals and Ethernet cables.</li> <li>3. Reset SMC using the procedure listed for this computer in Apple Support article <a href="#">HT3964: Intel-based Macs: Resetting the System Management Controller (SMC)</a> to return computer to a known power-off state. Try to power on from power-off state.</li> <li>4. Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time. Refer to Apple Support article <a href="#">PH14222: OS X Mavericks: Reset your computer's PRAM</a> for more information.</li> <li>5. Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</li> <li>6. Run Disk Utility or check Mac Resource Inspector (MRI) results to verify presence and SMART status of user's hard drive (HDD) or solid-state drive (SSD) / flash storage card. iMac models may have a hard drive or SSD / flash storage card, or both.</li> <li>7. Check Apple Support article <a href="#">HT1159: OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.</li> <li>8. Hold Shift key during startup to put computer into Safe Mode. See Apple Support article <a href="#">HT1564: OS X: What is Safe Boot, Safe Mode?</a></li> <li>9. Identify when during startup process computer hangs in order to isolate the issue. See Apple Support article <a href="#">HT2674: Intel-based Mac: Startup sequence and error codes, symbols</a>.</li> <li>10. If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD) / flash storage card, refer to Apple Support article <a href="#">HT5446: About Fusion Drive</a> for specific troubleshooting and restore processes.</li> </ol> <p><b>CAUTION:</b> Be extremely careful when working inside the computer with power applied and the system is energized. Avoid touching the logic board or power supply while the computer is plugged in. Always cover the power supply and logic board with power supply covers to protect yourself when working inside the computer.</p> <p>Before removing any components, be sure to turn off the computer and unplug computer from AC mains by disconnecting both ends of its power cord. Ensure that the computer is completely disconnected from AC mains before proceeding.</p> <p>For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP833: iMac and Displays: Power Supply Cover Instructions</a></li> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul>

	Check	Result	Action	Code	Commodity
1.	Reset PRAM by holding down Command-Option-P-R keys while restarting, until you hear the startup sound for the second time. A memory error is indicated by a sequence of one or three beep tones. Refer to Apple Support articles <a href="#">HT2341: Intel-based Mac Power-On Self-Test RAM error codes</a> for more information.  Does computer make error beep tones at startup?	Yes	Go to step 2.		
		No	Go to step 17.		
2.	Reset PRAM by holding down Command-Option-P-R keys while rebooting, until you hear the startup sound for the second time. A memory error is indicated by a sequence of one or three beep tones. Refer to Apple Support article <a href="#">HT2341: Intel-based Mac Power-On Self-Test RAM error codes</a> for more information.  Does computer make error beep tones at startup?	Yes	Go to step 3.		
		No	Go to step 18.		
3.	Reseat all memory modules securely in their slots and retest.  Does computer make error beep tones at startup?	Yes	Go to step 4.		
		No	Issue resolved. Verify resolution.		
4.	iMac (27-inch, Late 2012, Late 2013) computer models have four memory slots and may have up to four memory modules to test.  Does this computer have four memory slots?	Yes	Go to step 8.		
		No	Go to step 5.		

	Check	Result	Action	Code	Commodity
5.	Turn off computer. Unplug computer from AC mains by disconnecting both ends of its power cord. Ensure computer is completely disconnected from AC mains before proceeding.	Yes	Go to step 6.		
	<p>Remove LCD panel with glass.</p> <p>Remove logic board to access memory slots. Remove user's memory module from the first slot and substitute a known-good memory module into same slot. Reinstall logic board and LCD display (without VHB foam layers) and retest.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Does computer indicate a memory error with one known-good module and one user module?</p>	No	<p>Replace defective memory.</p> <p><b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
6.	Keep known-good memory module in the first slot and substitute second slot module with a second known-good memory module. Retest.	Yes	Replace logic board. Verify issue resolved.	M07	MLB
	Does computer indicate a memory error using two known-good memory modules?	No	Go to step 7.		



	Check	Result	Action	Code	Commodity
7.	Install first user memory module in first memory slot and test with a known-good memory module in second slot.	Yes	Replace both memory modules.  <b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.  Verify issue resolved.	X02	MEMORY
	Does computer indicate a memory error?	No	Replace defective memory.  <b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.  Verify issue resolved.	X02	MEMORY
8.	Typical configurations ship with two memory modules located in first two slots. It is possible to see a configuration with four memory modules installed.	Yes	Go to step 9.		
	Is user's computer configured with four memory modules installed?	No	Go to step 14.		
9.	Keep track of where memory is located as you work in pairs to isolate memory and later verify slot functionality. Remove user memory from second two slots and retest.	Yes	Go to step 14.		
	Does computer indicate a memory error with user memory in first two slots only?	No	Go to step 10.		
10.	Leave user memory installed in first two slots. Install two known-good memory modules in second two slots and retest.	Yes	Replace logic board. Verify issue resolved.	M07	MLB
	Does computer indicate a memory error with known-good memory in second two slots?	No	Go to step 11.		
11.	Leave the two installed known-good memory modules in second two slots. Remove user memory from first two slots and set aside as proven good user memory. Install user memory originally removed from second two slots and place this memory into proven good first two slots. Retest.	Yes	Go to step 13.		
	Does computer indicate a memory error with user memory in first two slots?	No	Go to step 12.		


	Check	Result	Action	Code	Commodity
12.	<p>Remove known-good memory from second two slots, leaving user memory (originally from second two slots) in first two slots. Install previously proven good user memory (originally from first two slots) into second two slots. Restart computer to verify user memory that has been reversed from original first two and second two slot configuration.</p> <p>Does computer indicate a memory error with user memory?</p>	Yes	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support. Situation - user memory passes test when paired known-good memory but fails when paired with like user memory.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
		No	Issue resolved with memory reconfiguration, memory/slot reseal. Verify resolution.		
13.	<p>Remove known-good memory from second two slots, leaving user memory in first two slots. Restart computer to verify user memory in first two slots as standalone with no memory in second two slots.</p> <p>Does computer indicate a memory error with user memory in first two slots only?</p>	Yes	Go to step 14.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support. Situation - user memory (currently located first two slots) fails when paired with known-good memory and passes when known-good memory is removed from adjacent slots.</p> <p>Click the Help button in the GSX Toolbar then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	


	Check	Result	Action	Code	Commodity
14.	<p>Remove user memory module from first slot and substitute a known-good memory module into same first slot. Retest.</p> <p>Does computer indicate a memory error with one known-good and one user module in first two slots?</p>	Yes	Go to step 15.		
		No	<p>Replace defective memory.</p> <p><b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
15.	<p>Keep known-good memory module in first slot and substitute second slot module with a second known-good memory module. Keep track of suspect user memory removed from second slot. Testing both first two slots with known-good memory will verify error is either defective slots or defective memory.</p> <p>Does computer indicate a memory error using two known-good memory modules in first two slots?</p>	Yes	<p>Replace logic board.</p> <p>Verify issue resolved.</p>	M07	MLB
		No	Go to step 16.		
16.	<p>Install first user memory module (removed from first slot) into second memory slot and test paired with a known-good memory module still in first slot.</p> <p>Does computer indicate a memory error?</p>	Yes	<p>Replace both user memory modules in first two slots.</p> <p><b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
		No	<p>Replace defective memory.</p> <p><b>Note:</b> You may not return non-Apple memory as KBB. Please verify Apple memory using MRI before returning to Apple.</p> <p>Verify issue resolved.</p>	X02	MEMORY
17.	<p>Check to see if diagnostic LED #3 is illuminated.</p> <p><b>Note:</b> Depending on computer model, this may require either simply looking through the bottom air flow opening or removing the LCD display.</p> <p>Is the diagnostic LED #3 illuminated?</p>	Yes	Go to step 18.		
		No	<p>Replace logic board.</p> <p>Verify issue resolved.</p>	M06	MLB

	Check	Result	Action	Code	Commodity
18.	Observe startup process to verify computer gets to initial gray screen after startup sound.	Yes	Go to step 19.		
	Does computer reach a gray screen during startup process?	No	Go to "Power But Blank/No Video" troubleshooting flow.		
19.	Verify that computer completes full startup process: Startup sound > gray screen > Apple logo > spinning gear > login screen > user's desktop.	Yes	Issue resolved. Verify resolution.		
	Does computer complete startup process to user's desktop?	No	Go to step 20.		
20.	Start up computer and determine whether a kernel panic is occurring. Refer to Apple Support article <a href="#">PH14063: OS X Mavericks: If your Mac restarts and a message appears.</a>	Yes	Go to "Kernel Panic/System Crashes" troubleshooting flow.		
	Does computer display a kernel panic during startup?	No	Go to step 21.		
21.	Use OS X Recovery to troubleshoot potential software issues. Hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery.</a>	Yes	Go to step 22.		
	Does computer start up from recovery partition?	No	Go to step 25.		
22.	Use a Fusion Drive-capable version of Disk Utility, Mac Resource Inspector (MRI), AST Storage Diagnostic or Apple Service Diagnostic (ASD) to determine whether the user's HDD/SSD/flash storage is recognized, and SMART status is verified.	Yes	Go to step 23.		
	Is user's HDD/SSD/flash storage detected and SMART status verified?	No	Go to "Hard Drive/SSD/Flash Storage Not Recognized/Not Mounting/Read-Write Issues" troubleshooting flow.		
23.	If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD) / flash storage, refer to Apple Support article <a href="#">HT5446: About Fusion Drive</a> for specific troubleshooting and restore processes.	Yes	Go to step 24.		
	Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> and use Disk Utility or MRI to determine if the user's HDD/SSD/flash storage has the correct system build for this computer model.	No	Restore correct version and build of OS X according to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> . Verify issue resolved.		
	Is correct version/build of OS X installed on user's hard drive/SSD/flash storage?				

	Check	Result	Action	Code	Commodity
24.	Run Disk Utility from the recovery partition to repair the user's HDD/SSD/flash storage. Attempt to start up from the user's HDD/SSD/flash storage.  Does computer start up successfully from user's HDD/SSD/flash storage?	Yes	Issue resolved. Verify resolution.		
		No	Restore correct version and build of OS X according to Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> . Verify issue resolved.		
25.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.</p> <p>Disconnect hard drive power and data cables at the hard drive. Remove SSD/flash storage card, if present. In order to verify the startup process with the LCD panel removed, connect an external display.</p> <p>Connect power cord to computer, wait five seconds for SMC to reset, then press power button. Hold down <b>Command-Option-R</b> keys during startup to force restart from OS X Internet Recovery over NetBoot. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</p> <p><b>CAUTION:</b> Be extremely careful when working inside the computer while power is applied and system is energized. Avoid touching the logic board or power supply while the computer is plugged in. For additional safety information and tips refer to Apple Support articles:</p> <ul style="list-style-type: none"> <li>• <a href="#">TP820: iMac (27-inch, Late 2012, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety</a></li> <li>• <a href="#">TP914: iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014): Safety</a></li> </ul> <p>Does computer start up from OS X Internet Recovery?</p>	Yes	Go to step 26.		
		No	Go to step 38.		
26.	To troubleshoot this issue completely, a known-good HDD or SSD/flash storage (depending on computer configuration) is required.  Do you have immediate access to a known-good HDD/SSD/flash storage?	Yes	Go to step 27.		
		No	Go to step 30.		


	Check	Result	Action	Code	Commodity
27.	Substitute known-good HDD/SSD/flash storage. Check Apple Support article <a href="#">HT1159: Mac OS X versions (builds) for computers</a> to make sure system build is correct for this computer model.  Does computer start up with known-good HDD/SSD/flash storage?	Yes	Go to step 28.		
		No	Go to step 30.		
28.	If the iMac is internally equipped with both a hard disc drive (HDD) and a solid-state drive (SSD) / flash storage, refer to Apple Support article <a href="#">HT5446: About Fusion Drive</a> for specific troubleshooting and restore processes.  Is user's computer configured with a Fusion Drive?	Yes	Go to step 30.		
		No	Go to step 29.		
29.	Identify the type of storage device affected: <ul style="list-style-type: none"><li>• Hard disk drive (HDD)</li><li>• Flash storage/solid-state drive (SSD)</li></ul> Is the affected device an HDD or SSD?	HDD	Replace the user's hard drive. Verify issue resolved.	H02	HDD
		SSD	Replace the user's flash storage/SSD. Verify issue resolved.	H02	SSD
30.	Reseat and inspect hard drive power cable. Look for damaged wires, and pin or connector housing damage.  Did you find any damaged components?	Yes	Go to step 32.		
		No	Go to step 31.		
31.	Identify the type of storage device affected: <ul style="list-style-type: none"><li>• Hard disk drive (HDD)</li><li>• Flash storage/solid-state drive (SSD)</li></ul> Is the affected device an HDD or SSD?	HDD	Go to step 33.		
		SSD	Go to step 36.		

	Check	Result	Action	Code	Commodity
32.	Multiple-component damage requires an escalation to TCS for multipart replacement.  Is damage limited to hard drive power cable only?	Yes	Replace hard drive power cable. Reinstall user's hard drive. Verify issue resolved.	X03	INTERNAL CABLE
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
33.	With hard drive power cable reseated, power on computer and verify hard drive disc spin-up, listening to disk spindle motor as it spins above 5000 RPMs.  Does hard drive seem to be spinning as expected?	Yes	Go to step 34.		
		No	Replace hard drive power cable. Reinstall user's hard drive. Verify issue resolved.	X03	INTERNAL CABLE
34.	To troubleshoot this issue completely, a known-good hard drive data cable is required.  Do you have immediate access to a known-good hard drive data cable?	Yes	Go to step 35.		
		No	Replace the user's hard drive. Verify issue resolved.	H02	HDD
35.	Substitute a known-good hard drive data cable and retest.  Does computer start up with known-good hard drive data cable?	Yes	Replace hard drive data cable. Reinstall user's hard drive. Verify issue resolved.	X03	INTERNAL CABLE
		No	Go to step 36.		

	Check	Result	Action	Code	Commodity
36.	<p>At this point in the troubleshooting process, you may be using the user's hard drive/SSD/flash storage or a known-good hard drive/SSD/flash storage.</p> <p>Which storage device type is currently installed?</p>	User's Hard Drive/SSD/flash storage	Go to step 37.		
		Known-Good HDD/SSD/flash storage	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	M99	
37.	<p>Identify the type of storage device affected:</p> <ul style="list-style-type: none"> <li>• Hard disk drive (HDD)</li> <li>• Flash storage/solid-state drive (SSD)</li> </ul> <p>Is the affected device an HDD or SSD?</p>	HDD	Replace the user's hard drive. Reinstall user's hard drive data cable. Verify issue resolved.	H02	HDD
		SSD	Replace the user's flash storage/SSD. Reinstall user's SSD data cable. Verify issue resolved.	H02	SSD
38.	<p><b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur. Remember to remove power cord whenever disconnecting modules or substituting cables and components.</p> <p>Remove wireless card from logic board. Reconnect hard drive power and data cables. Reconnect SSD, if present.</p> <p>Connect power cord to computer, wait five seconds for SMC to become ready, then press power button. Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a>.</p> <p>Does computer start up from recovery partition?</p>	Yes	Go to step 39.		
		No	Go to step 44.		
39.	<p>Inspect wireless card edge connector on logic board for bent pins or housing damage.</p> <p>Is logic board connector damaged?</p>	Yes	Replace logic board. Verify issue resolved.	M24	MLB
		No	Go to step 40.		



	Check	Result	Action	Code	Commodity
40.	Inspect wireless card for damage. Verify clean contact on card edge connector, no soot from electrical short, no broken antenna connections, proper heat transfer pad attached, and a flat surface overall. Confirm no bending or broken printed circuit board or EMI shield.  Is wireless card damaged?	Yes	Replace the wireless card. Verify issue resolved.	N17	WIRELESS DEVICE
		No	Go to step 41.		
41.	Reseat wireless card connection to logic board.  Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a> .  Does computer start up from recovery partition?	Yes	Issue resolved by reseating wireless card. Verify resolution.		
		No	Go to step 42.		
42.	To troubleshoot this issue completely, a known-good wireless card is required.  Do you have immediate access to a known-good wireless card?	Yes	Go to step 43.		
		No	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
43.	Substitute a known-good wireless card.  Use Startup Manager or hold down Command-R during startup to restart from the recovery partition. See Apple Support article <a href="#">HT4718: OS X: About OS X Recovery</a> .  Verify that Wi-Fi is present.  Does computer start up from recovery partition?	Yes	Replace wireless card. Verify issue resolved.	N13	WIRELESS DEVICE
		No	Replace logic board. Reinstall user's wireless card. Verify issue resolved.	M02	MLB
44.	<b>Important:</b> Ensure that user's computer is shut down, then remove power cord and wait two minutes for self discharge to occur.  Use multimeter to measure backup battery coin cell voltage at logic board test points TP2600 and TP2601, to determine whether replacement is needed. A good battery should be above 2.7 volts.  Is coin battery below 2.7 volts?	Yes	Replace coin battery. Verify issue resolved.	P01	OTHER ELECTRIC
		No	Go to step 45.		

	Check	Result	Action	Code	Commodity
45.	Locate logic board test points TP2602 and TP2603.	Yes	Go to step 46.		
	<p>Briefly short these two test points together using the tip of a flat blade screwdriver. This resets the computer's Real-Time Clock (RTC).</p> <p>Apply AC power and attempt to start up with a known-good coin battery.</p> <p>Does computer make a startup sound?</p>	No	Replace logic board. Verify issue resolved.	M02	MLB
46.	Verify that computer completes full startup process: Startup sound > gray screen > Apple logo > spinning gear > login screen > user's desktop.	Yes	Issue resolved by resetting the logic board. Verify resolution.		
	Does computer complete startup process to user's desktop?	No	Replace logic board. Verify issue resolved.	M02	MLB
47.	<p>Verify that computer can now complete startup process over multiple trials.</p> <p>Is issue resolved?</p>	Yes	Issue resolved.		
		No	 <p><b>ESCALATION REQUIRED.</b></p> <p>Contact TCS for additional support or a multiple-part repair.</p> <p>Click the Help button in the GSX toolbar, then choose Troubleshooting &gt; Technical Help with a Repair &gt; Contact Apple.</p>	X99	

# Becoming Qualified for iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014) Repairs

## Overview

In order to service any of these products:

- iMac (21.5-inch, Late 2012)
- iMac (27-inch, Late 2012)
- iMac (21.5-inch, Early 2013)
- iMac (21.5-inch, Late 2013)
- iMac (27-inch, Late 2013)
- iMac (21.5-inch, Mid 2014)
- iMac (Retina 5K, 27-inch, Late 2014)

Technicians must pass this qualification exam in addition to the ACMT certification:

- iMac (Late 2012 to Late 2014) Qualification Exam (9L0-S04)  
**Note:** Passing this one exam will qualify technicians to service all of the models listed above.

This requirement ensures that technicians will service these models correctly and provide users with the best possible experience.

## Important

- Technicians who have passed any previous version of the 9L0-S04 exam will be automatically qualified to service the iMac (Retina 5K, 27-inch, Late 2014). They do NOT need to retake the exam.
- Although there is no need to retake the exam, technicians are expected to review the updated service training course, iMac (Late 2012 to Late 2014), before attempting an iMac (Retina 5K, 27-inch, Late 2014) repair.

## Exam Preparation

The exam is based on one online course provided by AppleCare:

- [iMac \(Late 2012 to Late 2014\)](#)

Review the course before attempting the exam. It is recommended that you have the course available to you while taking the exam. Looking up specific information is permitted.

## Exam Instructions

The AppleCare iMac (Late 2012 to Late 2014) Qualification Exam (9L0-S04) is available from Pearson VUE:

- <http://www.pearsonvue.com/apple>

The exam costs \$15 US and is payable by credit card. The exam is open book and requires an overall score of at least 80% to pass.

**Important:** You must score 80% or higher in the Technician Safety section of the exam to pass. If you score lower than 80% in this section, you will fail the whole exam regardless of your performance in other sections.

## Additional Resources

Refer to Apple Support article [HT5474: Exams for Service Technicians](#) for more information.

Questions about exams or online courses can be addressed to [svc.trng@apple.com](mailto:svc.trng@apple.com).

# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Required Tools

## Required Tools

The following tools are required to service iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014):

- ESD-safe workstation, including an ESD mat and wrist or heel strap
- ESD bags (to store ESD-sensitive parts while removed from the computer)
- Starter kit, LCD display panel (076-1444) - only available for iMac (21.5-inch) and iMac (27-inch, Late 2012 and Late 2013).  
**Note:** For the iMac (Retina 5K, 27-inch, Late 2014), VHB is only available via refill kit (076-00009)
- Display refill kit, Very High Bond, VHB, 6-piece set, pack of 20 (076-00009), iMac (Retina 5K, 27-inch, Late 2014)
- Display refill kit, Very High Bond, VHB, 6-piece set, pack of 20 (076-1419), iMac (27-inch, Late 2012, Late 2013)
- Display refill kit, Very High Bond, VHB, 6-piece set, pack of 20 (076-1437), iMac (21.5-inch)
- Kit, display removal wheels, pack of 20 (076-1417)
- iMac service foam locking wedge (part of starter kit, 076-1444, not available separately)
- Torx T25 screwdriver (27-inch models) (magnetized)
- Torx T10 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)
- Torx T6 screwdriver (magnetized)
- Torx T5 screwdriver (magnetized)
- Torx T4 screwdriver (magnetized)
- Phillips #00 screwdriver
- Pentalobe driver, for VESA mount (923-0367)
- Black stick or other nonconductive nylon or plastic flat-bladed tool
  - Black stick, 922-5065, pack of 4
  - Black stick, 922-9004, pack of 24
  - Black stick, 922-9005, pack of 96
- Thunderbolt and USB cables for logic board replacement
- Earphones for audio cable reassembly
- Thermal material (twinpak) kit (076-1425) (see important note below)
- Thermal pad kit (076-1445)
- Display cable extension kit (076-1428), iMac 21.5-inch (for testing the panel and cables with the panel off)
- Display cable extension kit (076-00010), iMac (Retina 5K, 27-inch, Late 2014) (for testing the panel and cables with the panel off)
- Display cable extension kit (076-1431), iMac (27-inch, Late 2012 and Late 2013) (for testing the panel and cables with the panel off)
- Power supply protective covers (923-0189) (to use when performing live adjustments with the panel off)
- Kapton tape
- Painter's tape (tape that does not leave a residue, 1–2 inches wide, but preferably 2 inches if available)
- Isopropyl alcohol (IPA) wipes, 95% or higher isopropyl
- Magnifying glass (for reading the serial number etched on the bottom of the stand)
- Digital volt meter (for troubleshooting)
- Soft, clean towel or cloth (to protect the display and other removed parts from scratches)
- Sticky notes

**Note:** On July 17, 2013, a new thermal pad kit replaced the original twinpak of thermal material (076-1425) necessary for installing wireless cards in iMac (Late 2012 and Early 2013) models. The new thermal pad kit is included with wireless card and logic board replacement parts, and is also available separately (076-1445). If your packet of thermal material (076-1425) has not expired, you may use it; however, it is easier, cleaner, and quicker to install a thermal pad.

Whenever you remove or replace the wireless card in an iMac (Late 2012 and Early 2013), check for the original thermal material. If it is present, remove the original thermal material, clean the area with an IPA wipe, and install one thermal pad to the wireless card.

## Required Special Tools and Supplies for Display Panel

The display is secured to the rear enclosure using adhesive strips. When a repair requires the removal of the display panel, the Very High Bond (VHB) adhesive strips must be cut and replaced.

The display removal procedure requires these special tools:

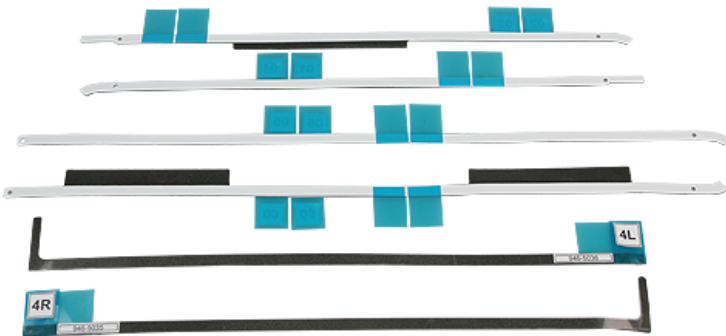
- iMac service foam locking wedge



- Display removal handle and wheel



- Very High Bond (VHB) adhesive strips



- 076-1444 – Starter kit, LCD display panel
  - Handle, display removal tool (1)
  - Display removal wheel (8)
  - Very High Bond (VHB) adhesive strip 6-piece set for iMac (27-inch, Late 2012 and Late 2013) (4 sets)
  - Very High Bond (VHB) adhesive strip 6-piece set for iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014) (4 sets)
  - iMac service foam locking wedge
- 076-00009 – Display refill kit, iMac (Retina 5K, 27-inch, Late 2014)
  - Display removal wheel (20)
  - Handle, display removal tool, iMac (1)
  - Very High Bond (VHB) adhesive strip 6-piece set (20)
- 076-1419 – Display refill kit, iMac (27-inch, Late 2012 and Late 2013)
  - Display removal wheel (20)
  - Handle, display removal tool, iMac (1)
  - Very High Bond (VHB) adhesive strip 6-piece set (20)
- 076-1437 – Display refill kit, iMac (21.5-inch Late 2012, Early 2013, Late 2013, Mid 2014)
  - Display removal wheel (20)
  - Handle, display removal tool, iMac (1)
  - Very High Bond (VHB) adhesive strip 6-piece set (20)
- 076-1417 – Kit, display removal wheels, pack of 20
- 922-9468 – ESD bags, 24x30-inch, pack of 5, to accommodate a 27-inch display
- 922-8258 – ESD bags, 24x20-inch, pack of 5, to accommodate a 21.5-inch display
- 922-8259 – Microfoam bag to store display panel, pack of 5
- 922-8261 – Sticky silicone roller (6-inch) to adhere VHB strips to the display panel

- 922-8262 – Sticky sheet pads (to clean silicone roller or pick up shards of broken glass)
- 922-8263 – Polishing cloths, anti-static, optical-grade microterry, pack of 5
- Isopropyl alcohol (IPA) wipes, 95% or higher isopropyl
- Painter's tape (tape that does not leave a residue, 1 to 2 inches wide, but preferably 2-inch, if available)

### **LCD Support Stand for iMac Repair**

Use the corrugated stand to support the LCD panel during an iMac repair or when working on a VESA mount-adapted system.

- LCD service support stand (923-0416)



# iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014), iMac (27-inch, Late 2012 and Late 2013), and iMac (Retina 5K, 27-inch, Late 2014): Cleaning and Handling a Broken Display Panel

## Tools for Cleaning the Display Panel

- Safety glasses
- Service wedge (iMac) (included with the display panel starter kit, 076-1444)
- Clean, damp cloth (to clean display panel glass)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)

## Cleaning the Display Panel

1. Clean the front of the display with a clean, damp, lint-free cloth. **Note:** Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.
2. Polish the display panel with an anti-static, micro-terry, optical-grade polishing cloth (922-8263, package of five).



## Glass Safety Precautions

These models have a glass display panel that attaches to the front of the computer, which must be removed to access internal components:

- iMac (21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014)
- iMac (27-inch, Late 2012 and Late 2013)
- iMac (Retina 5K, 27-inch, Late 2014)

## Handling a Broken Display Panel

- The display panel's glass is not tempered and will break into sharp pieces if mishandled. Removing the display panel requires special tools.
- Safety glasses are recommended when removing the display panel.

## Tools

- Display panel starter kit (076-1444)
- Leather gloves or equivalent cut-resistant gloves
- Packing tape or equivalent
- Safety glasses
- Large ESD bags (922-8258) – 24x20-inch bags that accommodate a 21.5-inch display, package of five
- Large ESD bags (922-9468) – 24x30-inch bags that accommodate a 27-inch display, package of five
- Large box for disposal

## Safety Information



### If the display panel breaks and a glass shard enters the eye:

- Seek medical attention immediately!
- Do not rub your eye if you feel you have something in your eye.
- Do not use an eye wash. An eye wash can push or move the shard of glass and cause more damage.
- Keep the eye closed or loosely patch the eye to keep the eye from moving.



## Handling a Broken Display Panel

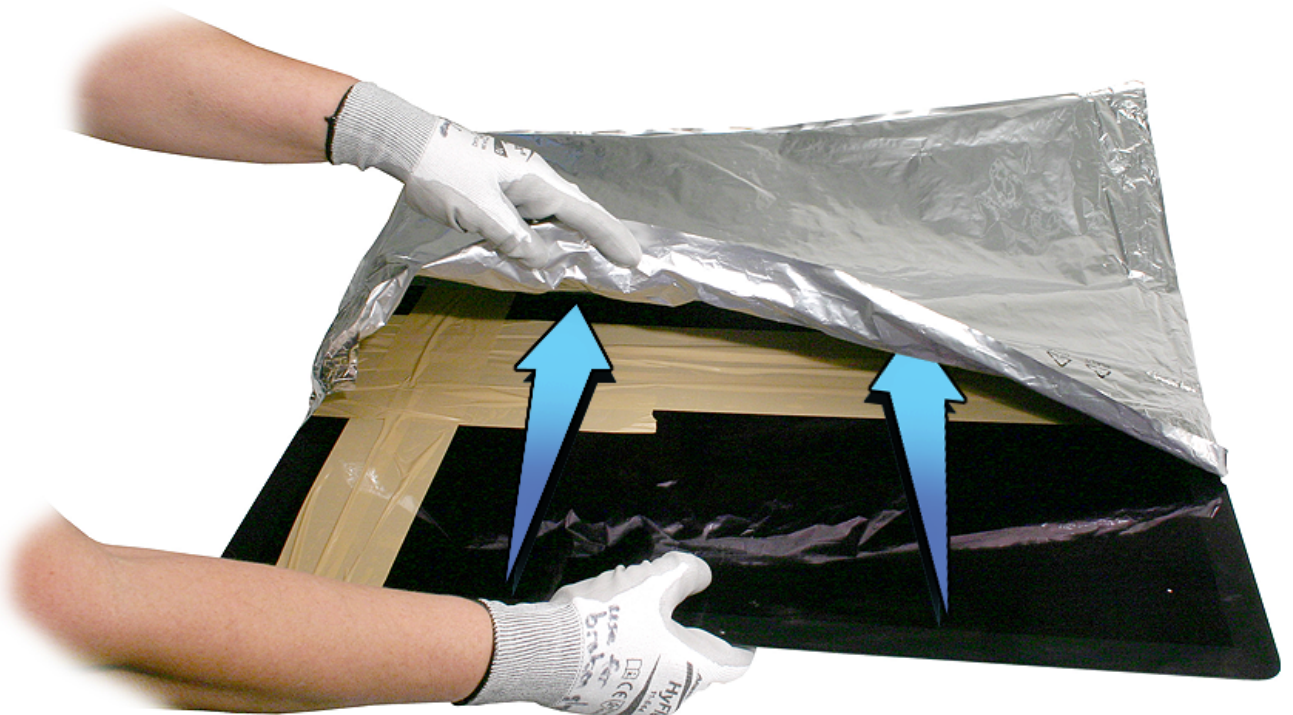
1. Put on safety glasses and leather gloves.
2. If the display panel is broken and is still attached to the rear housing, secure the broken glass with packing tape and carefully follow the Display Panel Removal procedure.
  - [RP1021: iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\): Display Panel Removal](#)
  - [RP950: iMac \(27-inch, Late 2012 and Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Display Panel Removal](#)
3. Lay the display panel on a smooth, clean work surface.
4. Apply tape, thoroughly covering the broken display panel.





4.

5. Place the taped display panel in the ESD bag that the replacement panel came in (or an equivalent large bag).



6. Place the display panel inside a large box, label the box "Broken Glass," and return the display back to Apple using the normal return process.



## iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Safety



**WARNING: HIGH VOLTAGE:** Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, because the power supply retains a charge whether or not the computer is on.

**Discharge wait time:** After unplugging the computer from the electrical outlet, wait two minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is turned off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge stored voltage to a safe level after being unplugged.

Refer to Apple Support article [TP833: iMac and Displays: Power Supply Cover Instructions](#) for additional information on installing the protective covers. The power supply cover provides protection against unintended contact with the energized power supply, which may result in injury from electric shock. ALWAYS use the protective power supply cover during service when the glass panel and LCD have been removed from the iMac, LED Cinema Display, and Thunderbolt Display.

**WARNING:** The iMac (Late 2012 and later) models require two protective covers (923-0189) when performing live adjustments; one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in the last image below.

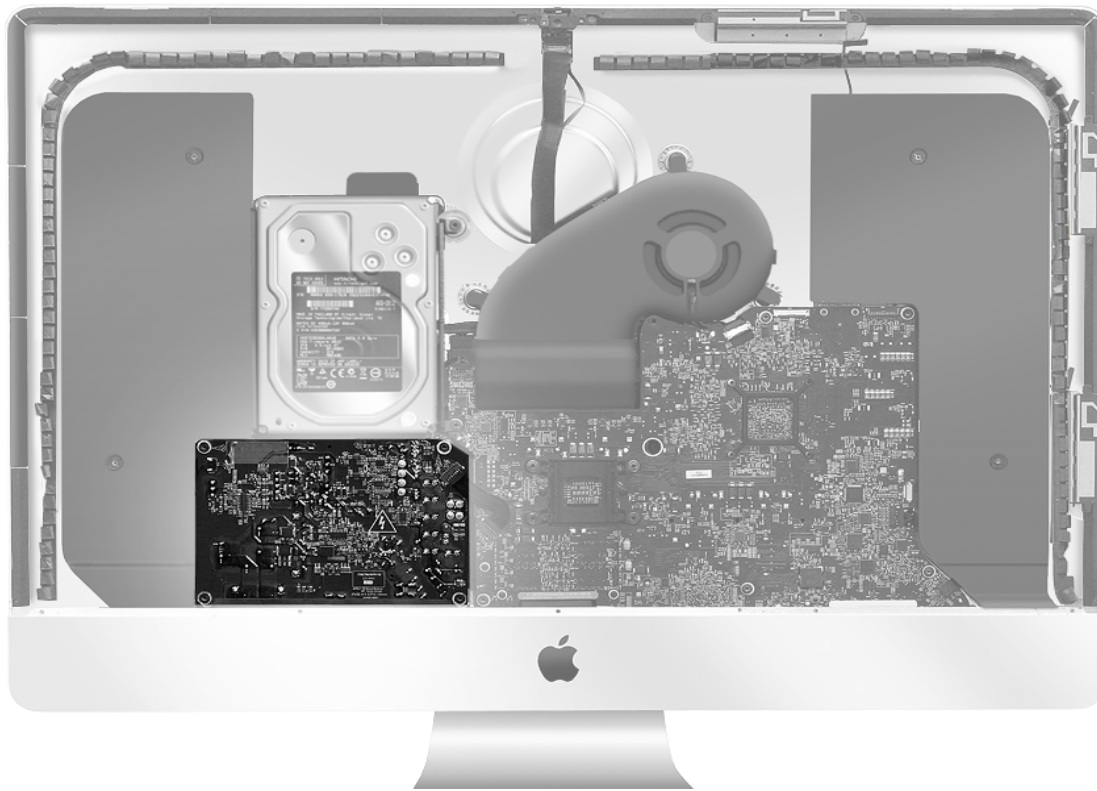
### Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

1. **Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles** which increase your risk of electric shock.
2. **Do not wear a cell phone or other signaling device**, as these may cause a dangerous startle reflex during energized work.
3. **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing an ESD grounding system increases your risk of electric shock in this situation.
4. **Remain alert**, focused on the work being performed, and aware of the proximity of grounded objects to your body.
5. **Use the plastic black stick or other non-metal extension tool as needed** to connect or disconnect cables, to keep fingers away from potentially energized parts.

**iMac (27-inch, Late 2012 and later): Power supply location**





**iMac (27-inch, Late 2012 and later: Logic board location**



**iMac (27-inch, Late 2012 and later): Protective power supply cover placement**

**WARNING:** Use the protective power supply covers when the computer is plugged in or when performing live adjustments. On these models, place a cover over both the power supply and the logic board when doing live adjustments. Avoid touching the logic board or power supply while the computer is plugged in and the display panel has been removed.

Refer to Apple Support articles:

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP981: iMac \(27-inch, Late 2012 and Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Testing the Panel Using the Display Extension Cable Kit](#)



# Take Apart Procedure Notes

## Reassembly Steps

When no replacement steps are listed, replace parts in exact reverse order of Removal procedure.

## Note About Images in This Guide

In some cases a pre-production model may have been used to document the procedures in this guide. Although there may be small differences in appearance between the image pictured and the computer you are servicing, the procedures are the same unless noted.

## Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



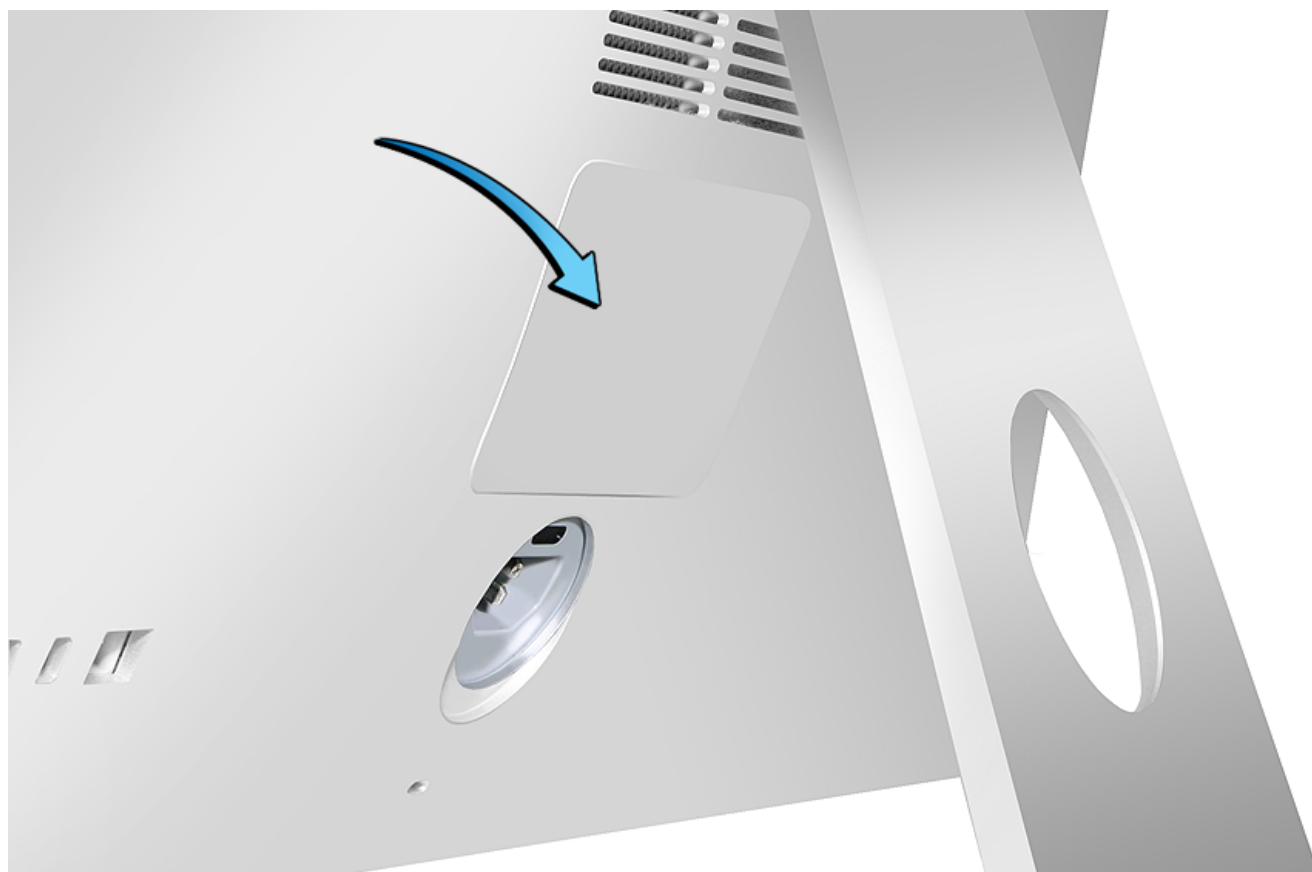
# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): RAM Access Door

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

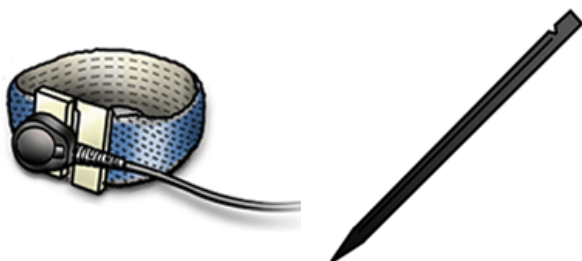
Before you begin:

- Shut down the computer.
- Unplug power and disconnect peripherals.
- Put on an ESD wrist strap.



## Tools

- ESD wrist strap and mat
- Black stick or flat-blade screwdriver
- Clean towel or soft cloth

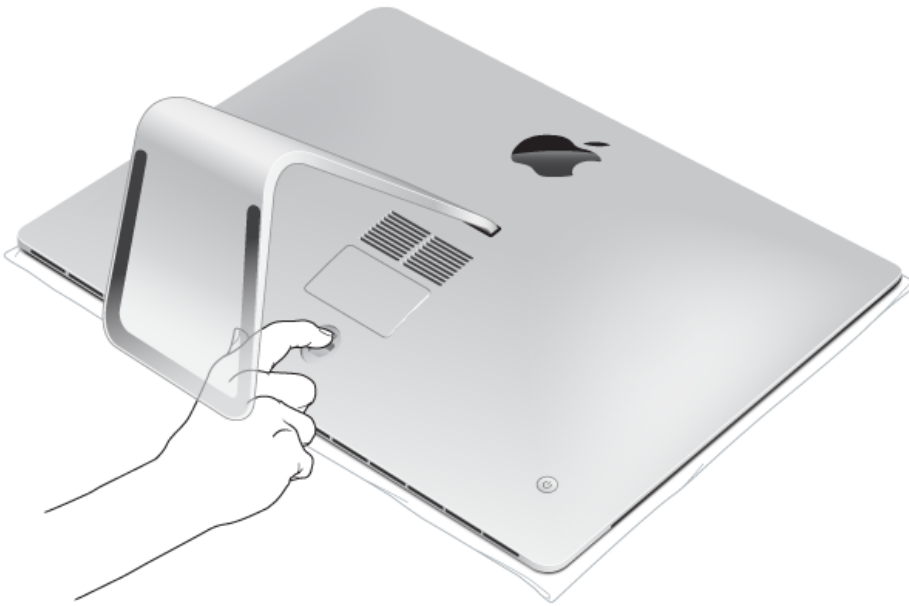


## Steps For Removal

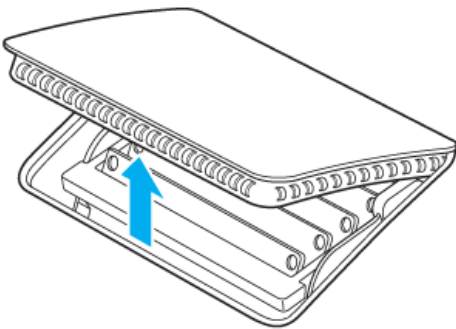
1. Place a soft and clean towel or cloth on desk or other flat surface to prevent scratching the display.

2. Lay the computer face down on the towel or cloth.

3. For this step, use your finger, a black stick, or a small flat-blade screwdriver. Open the SDRAM compartment door by pressing the small black button located just above the AC power port. The SDRAM compartment door will open as the button is pushed in.



4. Remove the compartment door and set it aside.



### Steps For Reassembly

Replace the RAM compartment door. There is no need to press the compartment door release button when replacing the compartment door.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Memory

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

## General Information

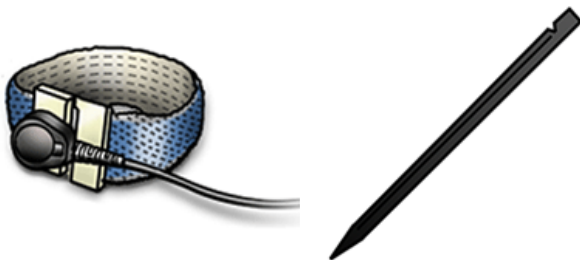
iMac (27-inch, Late 2012 and later) computers have four (4) SO-DIMM DDR3 SDRAM (synchronous dynamic random-access memory) slots located in a compartment on the rear of the computer, just above the AC power cord receptacle. You can use one 4GB or 8GB SDRAM SO-DIMM of 1600 MHz DDR3 SDRAM in each slot. The maximum amount of SDRAM you can install in the iMac is 32GB (one 8GB SO-DIMM in each slot).

## Memory Location



## Tools

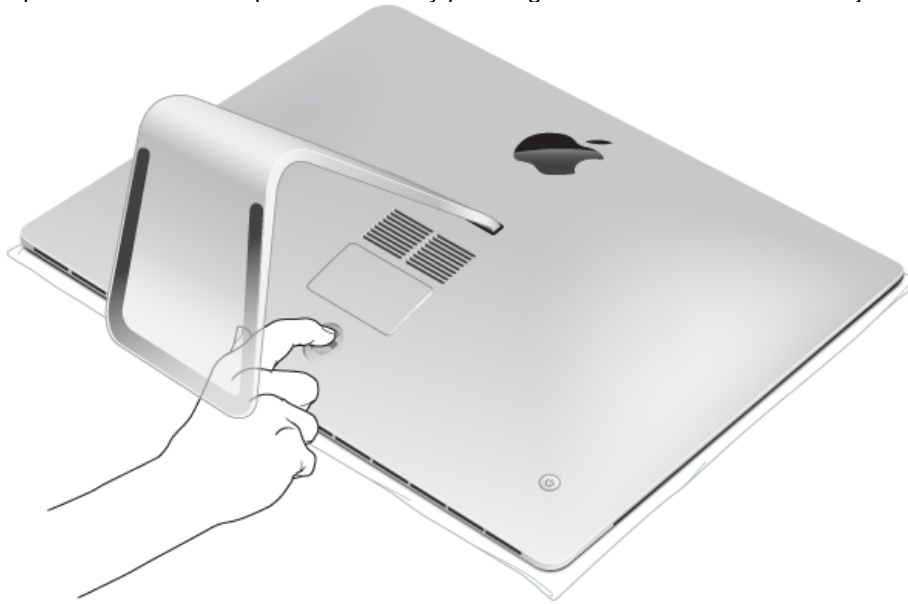
- ESD wrist strap and mat
- Black stick
- Soft cloth or clean towel



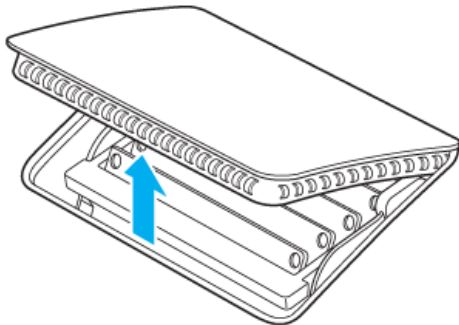
## Steps For Removal

1. Turn off the computer by choosing Shut Down from the Apple () menu.
2. Disconnect the power cord and all other cables from the computer.

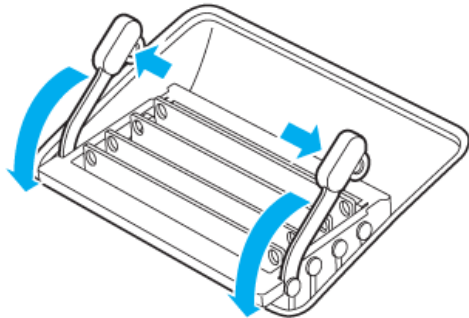
3. Place a soft, clean towel or cloth on the desk or other flat surface to prevent scratching the display.
4. Hold the sides of the computer and carefully lay the computer face down on the towel or cloth.
5. For this step, use your finger or a black stick:
  - Open the SDRAM compartment door by pressing the the small button located just above the AC power port.



- The SDRAM compartment door will open as the button is pushed in. Remove the compartment door and set it aside.  
**Note:** There is a diagram on the underside of the compartment door which shows the memory cage levers and the orientation of the DIMM.



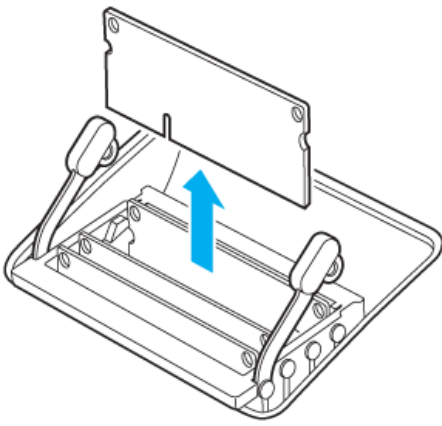
- Locate two levers on the right and left sides of the memory cage. Push the levers outward to release the memory cage.



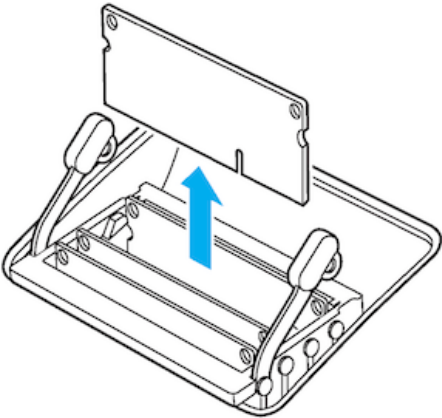
6. After the memory cage is released:

- Pull the memory cage levers toward you, allowing you to access each individual DIMM slot.
- Remove a DIMM module by pulling the module straight up and out, handling it only by the left and right edges.

**iMac (27-inch, Late 2012)**

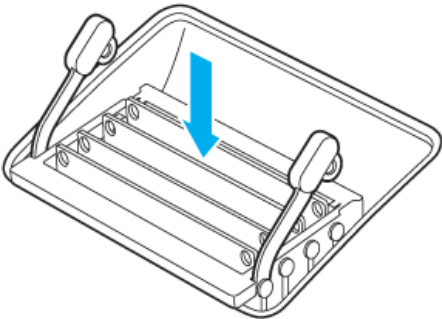


**iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014)**

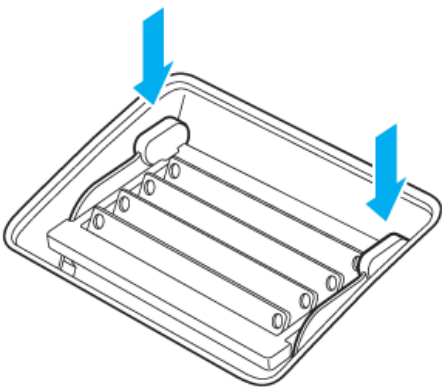


### Steps For Reassembly

1. Replace or install a DIMM by setting it down into the slot and pressing until you feel the DIMM click into the slot.



2. After you have installed the modules, push the memory cage levers back into the housing until they click back into place.



3. Place the computer in an upright position.
4. Reconnect the power cord and all other cables to the computer, then start up the computer.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Display Panel Removal

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV116: Display Panel Removal Video](#).

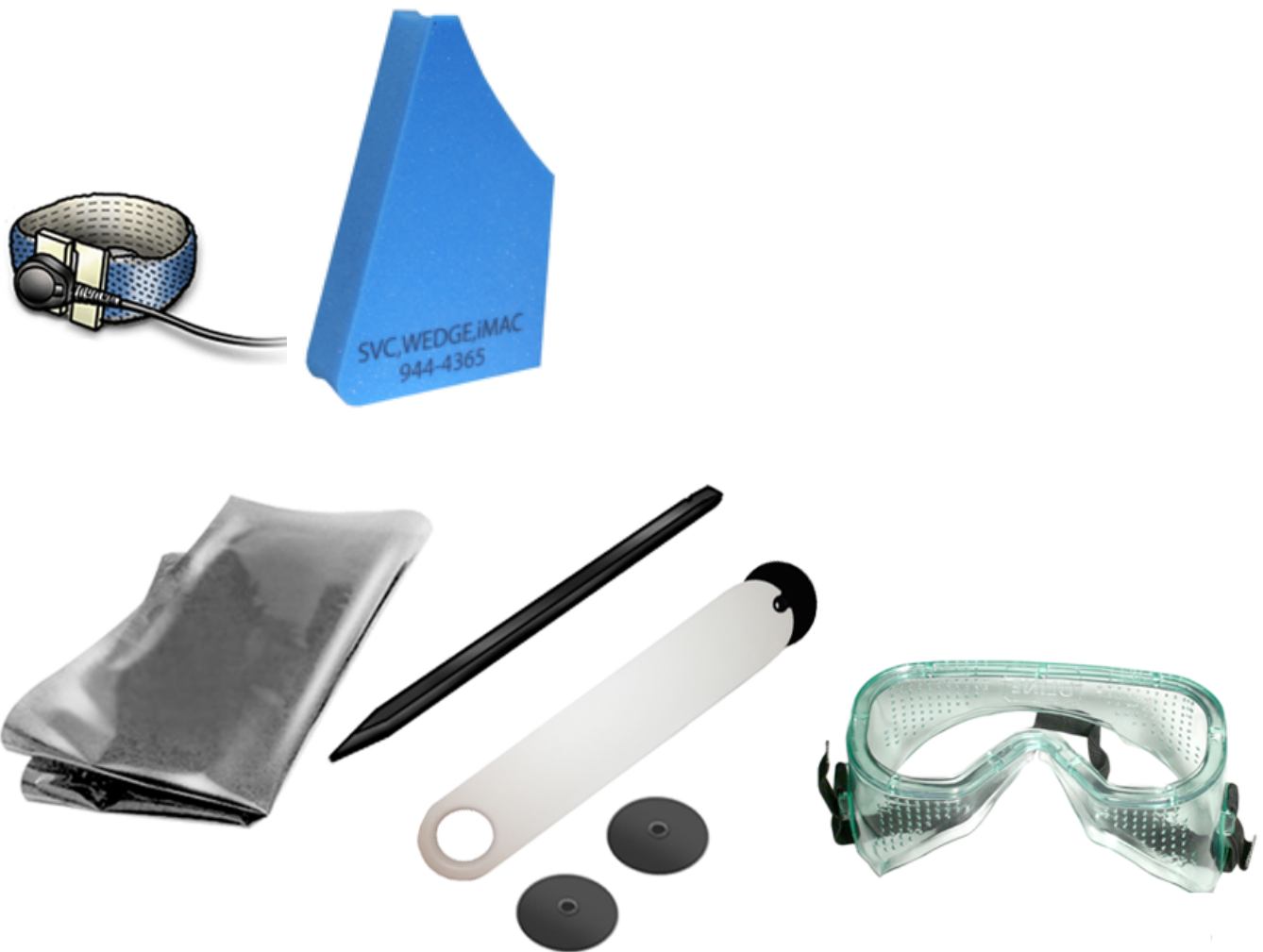
Before you begin:

- Shut down the computer.
- Unplug power and disconnect peripherals.
- Put on an ESD wrist strap.



## Tools

- ESD wrist strap and mat
- Service wedge (iMac)
- ESD-safe bag
- Black stick
- Display removal tool
- Replacement wheels for display removal tool (several)
- Safety glasses



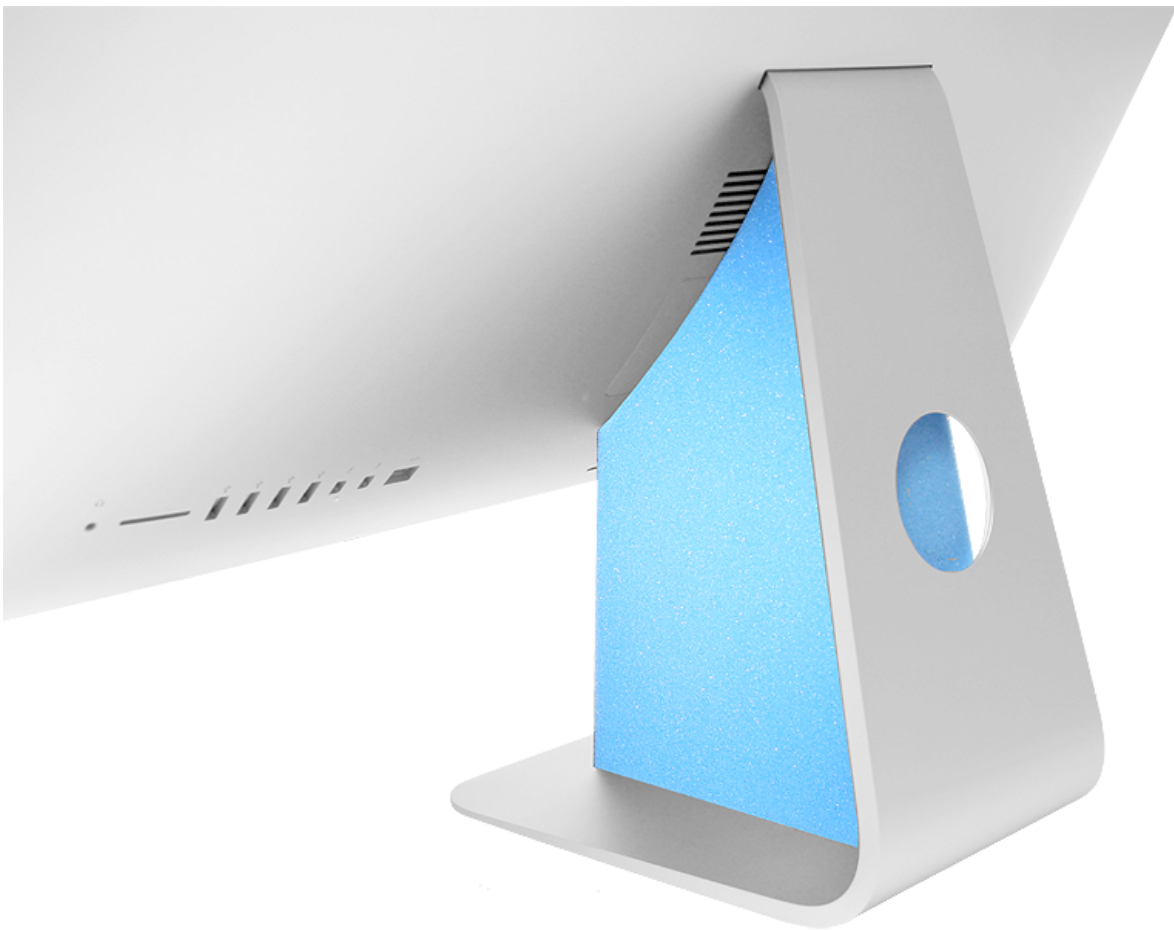
The display panel must be removed for all repairs. The display is affixed to the computer housing with very high bond (VHB) adhesive strips. These VHB strips must be cut with the display removal tool in order to remove the LCD panel. Each VHB strip consists of two adhesive layers and a foam layer (VHB/foam/VHB). When you remove the display, you are cutting primarily through the foam layer.

The main tool is the display removal tool. The tool uses replaceable wheels (076-1417) that cut through the foam layer in the VHB strip. With careful use, these wheels can be reused five to ten times. When the wheel becomes nicked from contact with the chin, further use becomes difficult. Because of this, the tool should only be used along the top and sides of the display, and not along the chin. To remove the VHB strips along the chin, lower the display and pull the outer vertical tab on the strips.

## Steps For Removal

**Note:** In the unlikely event that the display glass cracks or breaks, refer to [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Use the service wedge to hold the display steady. When positioned correctly, the service wedge covers the power receptacle. Rotate the computer so the display panel is facing you.

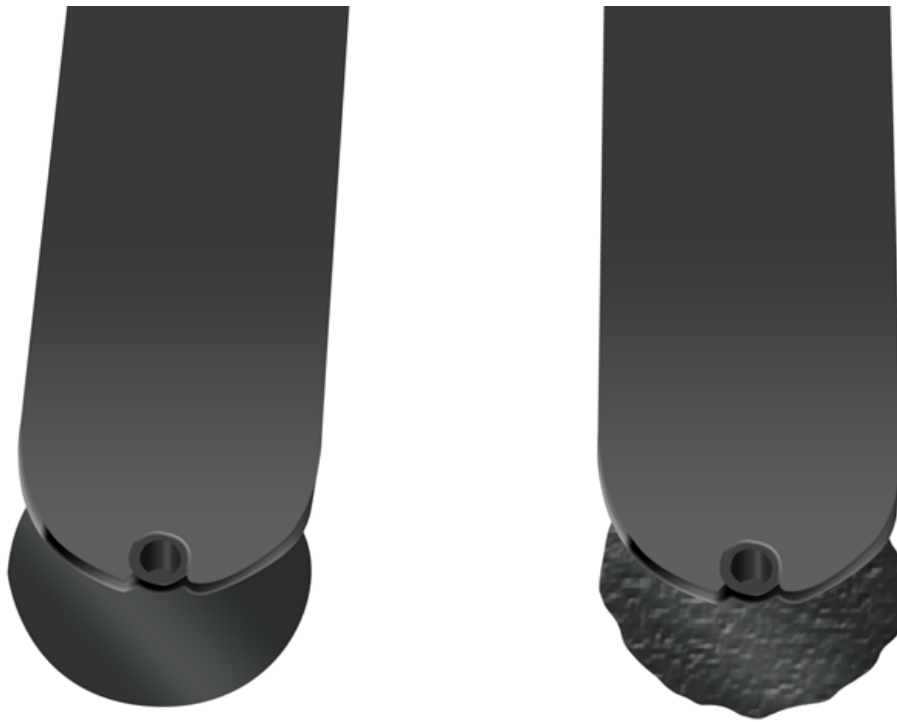


2. Place a wheel on the removal tool by inserting the wheel into the notch on the handle. Push firmly until the wheel clicks into the notch. The tool cuts the foam core, which is located between two layers of Very High Bond (VHB) adhesive that secure the display panel to the rear housing.

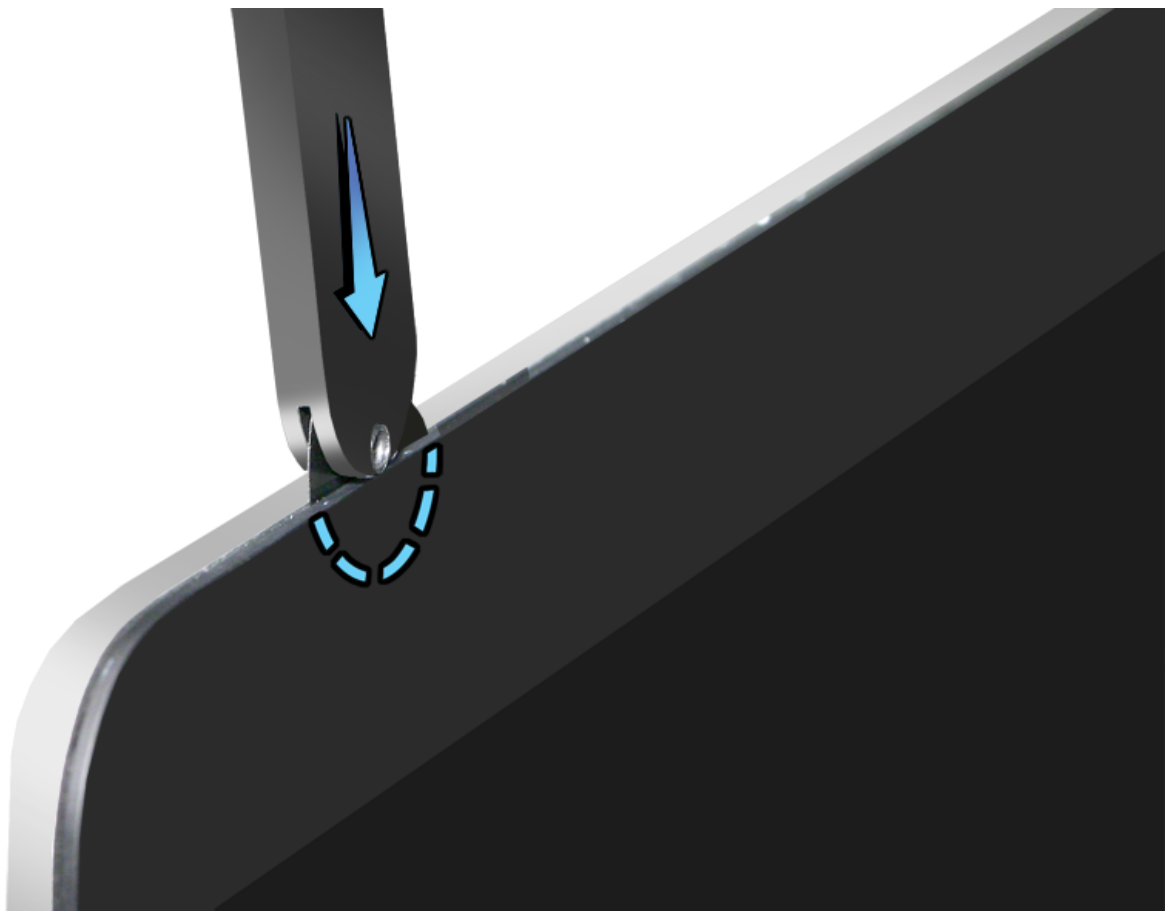
**Note:** With careful use, these wheels can be reused five to ten times. When the wheel becomes nicked from contact with the chin, further use becomes difficult. Because of this, the tool should only be used along the top and sides of the display, and not along the chin. To remove the VHB strips along the chin, lower the display and pull the outer vertical tab on the strips.



**Note:** If the wheel becomes worn during use, change the wheel. A worn wheel could permanently damage the black Mylar that is adhered to the edges on the back of the display panel glass.

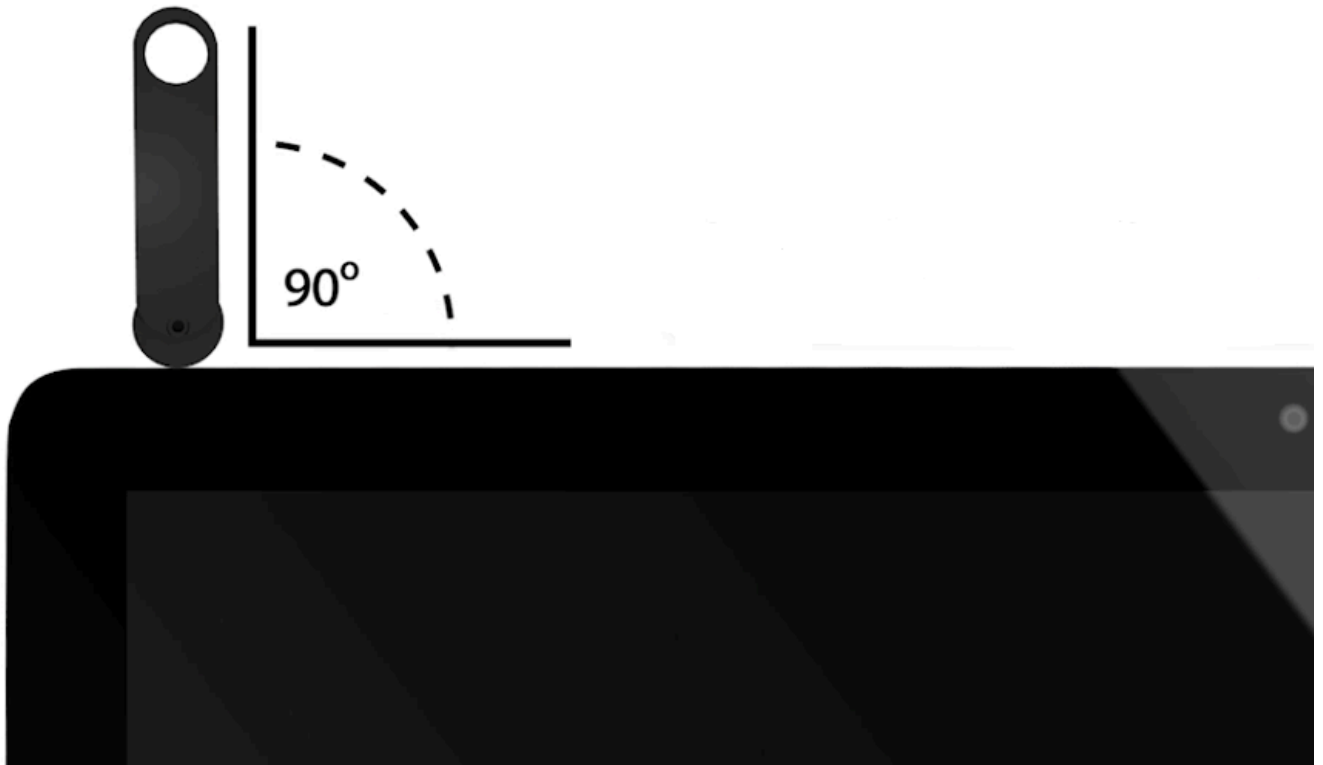


3. Use only the display removal tool to cut through the foam layer of the VHB adhesive. Insert the display removal tool into the gap between the display panel and rear housing. **Note:** The tool should only be used along the top and sides of the display, not along the chin.



4. Hold the display removal tool perpendicular to the edge of the computer.





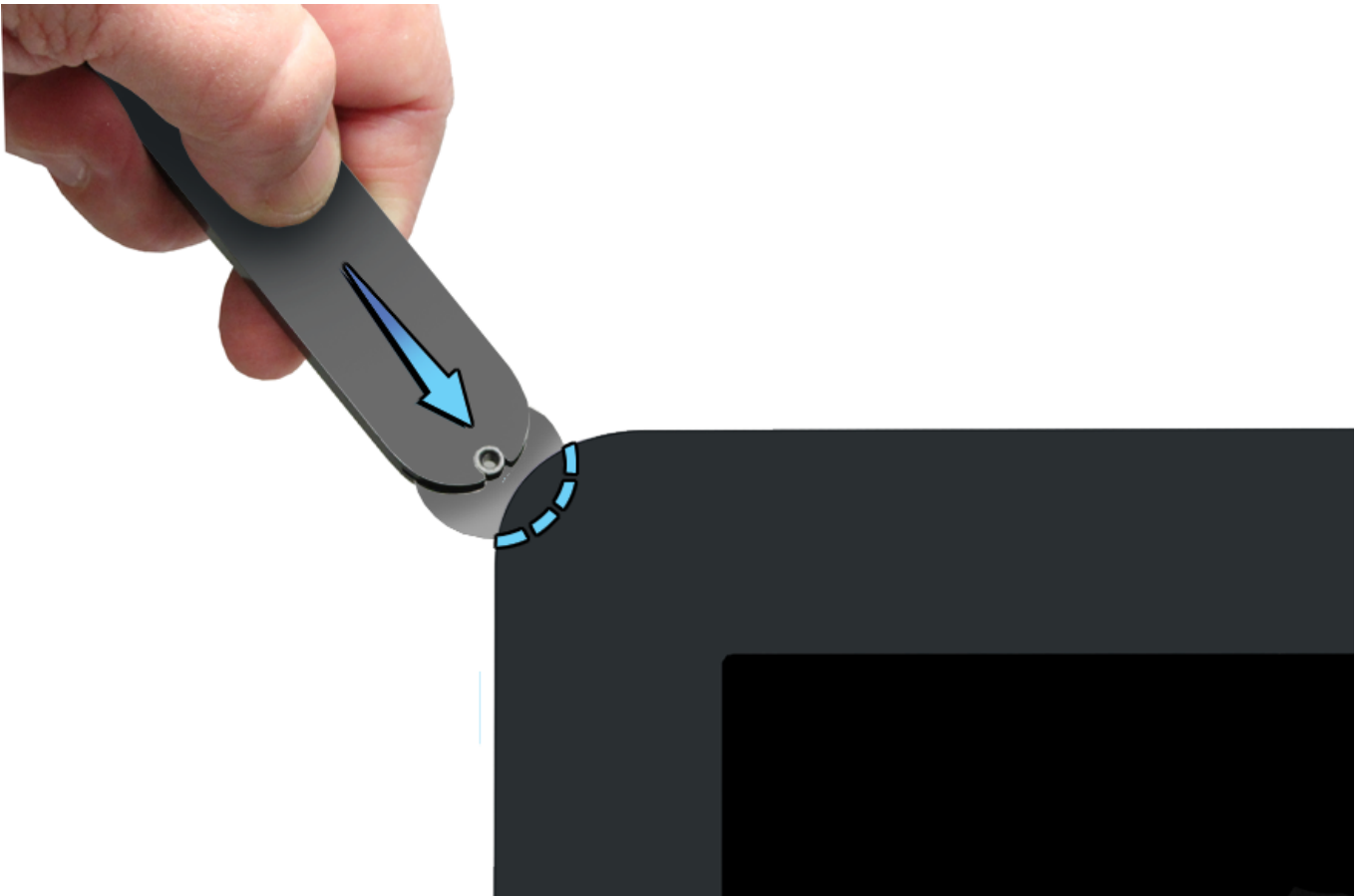
5. Roll the tool along the top and sides of the display panel. Move the tool back and forth until it moves with minimal resistance.

**Note:** Because there is no VHB adhesive at the top center, where the camera is located, there is no need for a continuous swipe across the top.



6. Pay special attention to the top corners, as the tool must make steady contact with the display and housing.





7. Use the flat end of a black stick to gently remove any visible VHB from the edges of the rear housing.

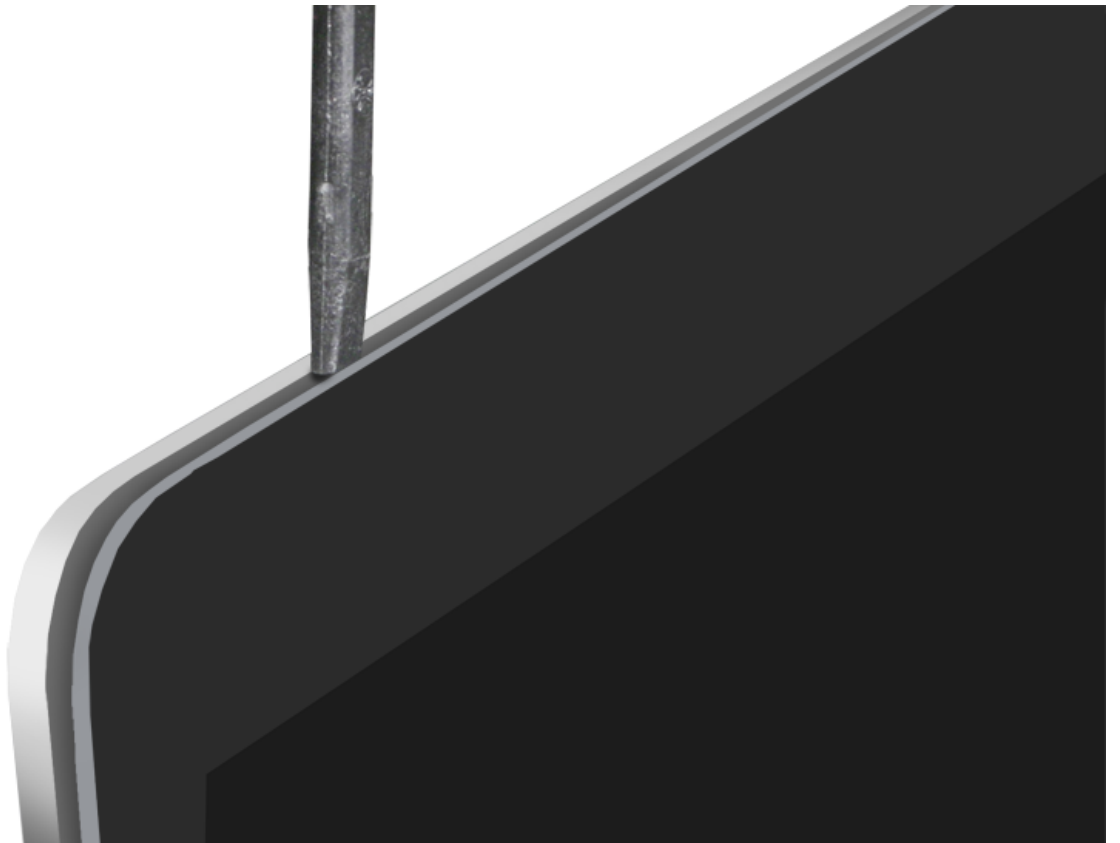
**Caution:** Forcing the black stick between the display panel and the rear housing may cause the display panel to fracture.



**Note:** Pay special attention to the location of the Wi-Fi/Bluetooth antennas. **Do not pry** in these areas with the black stick.



8. Use the black stick and your fingers to carefully separate the display panel from the top of the rear housing. If there is resistance, you need to remove more VHB material.





9. Tilt the display open slightly, just enough for your hand to reach the cables that connect the display to the logic board.

**Important: Be extremely careful not to stress the display cables and connectors (on the logic board) when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, the logic board will need to be replaced.**

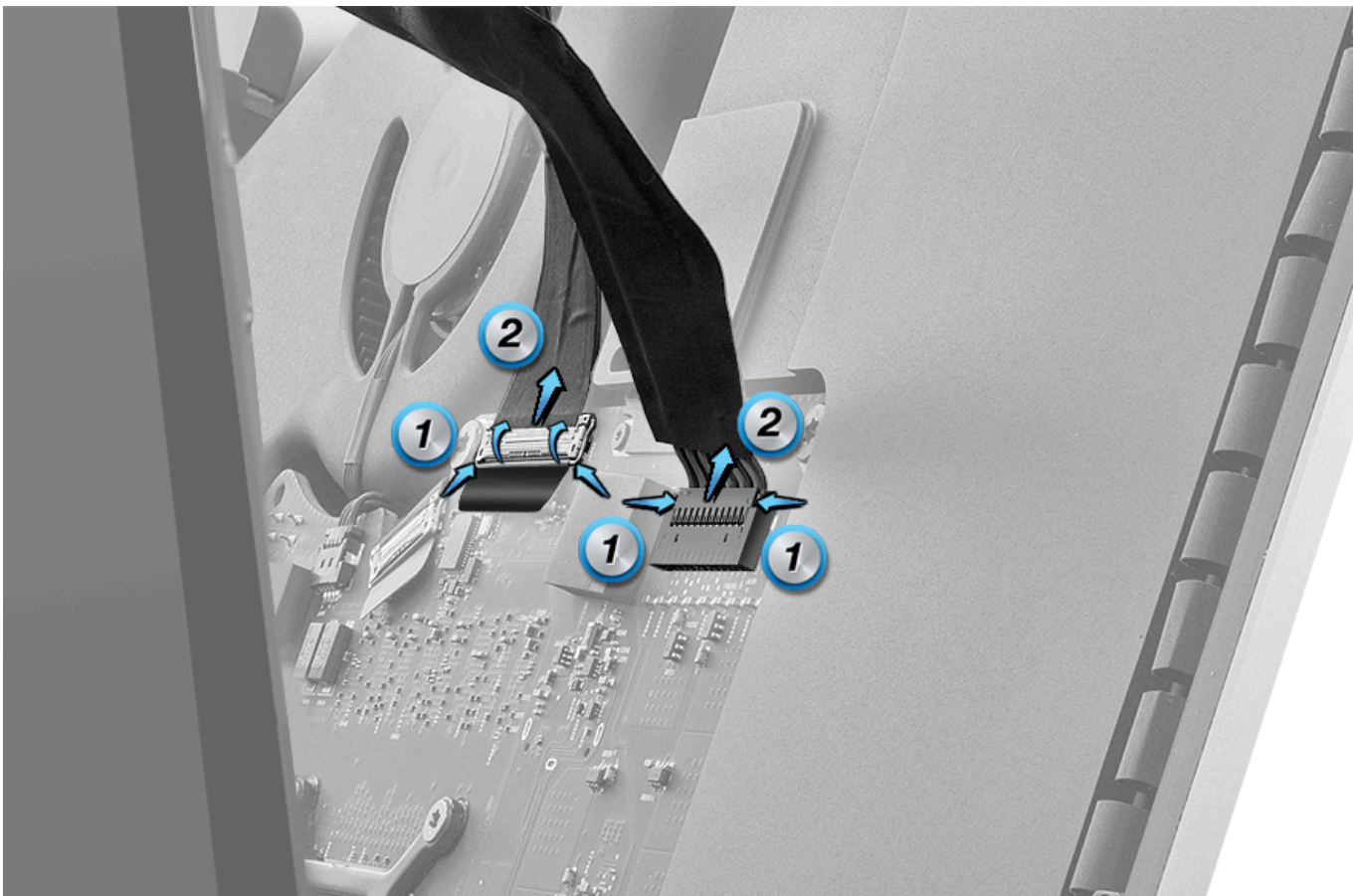
Remember that the bottom edge of the display is still attached with VHB. **Do not** remove the display panel yet.



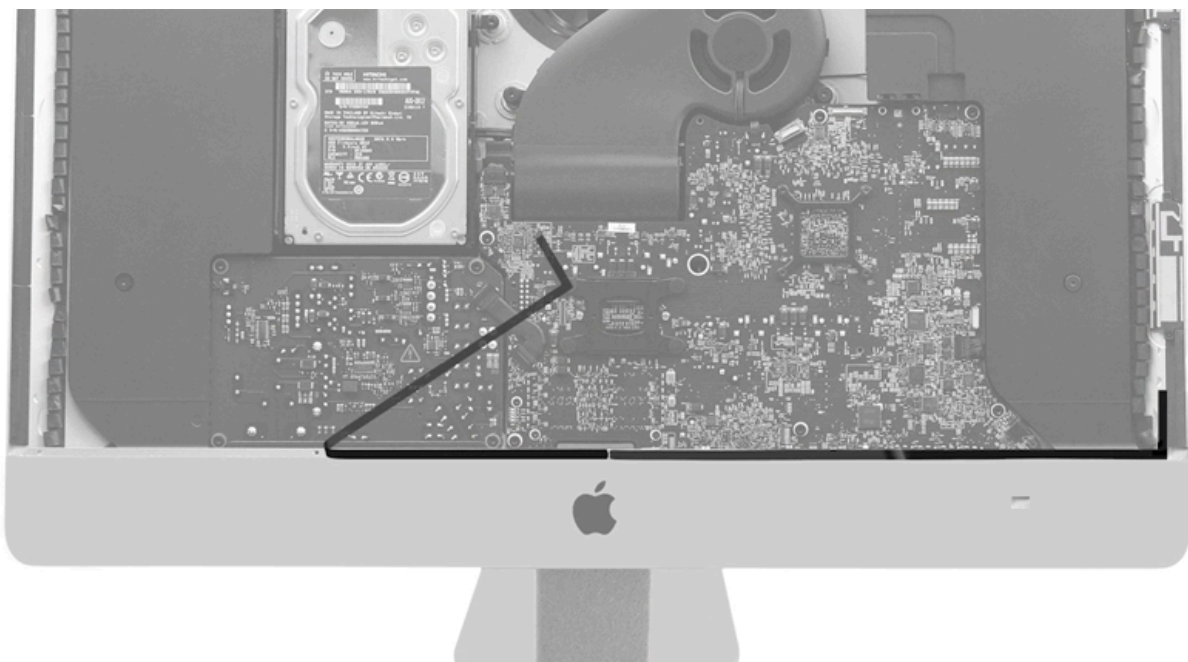
10. Carefully remove the Embedded DisplayPort (eDP) cable (on the left) from the logic board by moving the locking lever (#1) up and pulling the cable (#2) straight out of its connector. Disconnect the display backlight power cable (on the right) from the logic board by pinching the sides (#1) and pulling the power cable (#2) straight out of its connector.

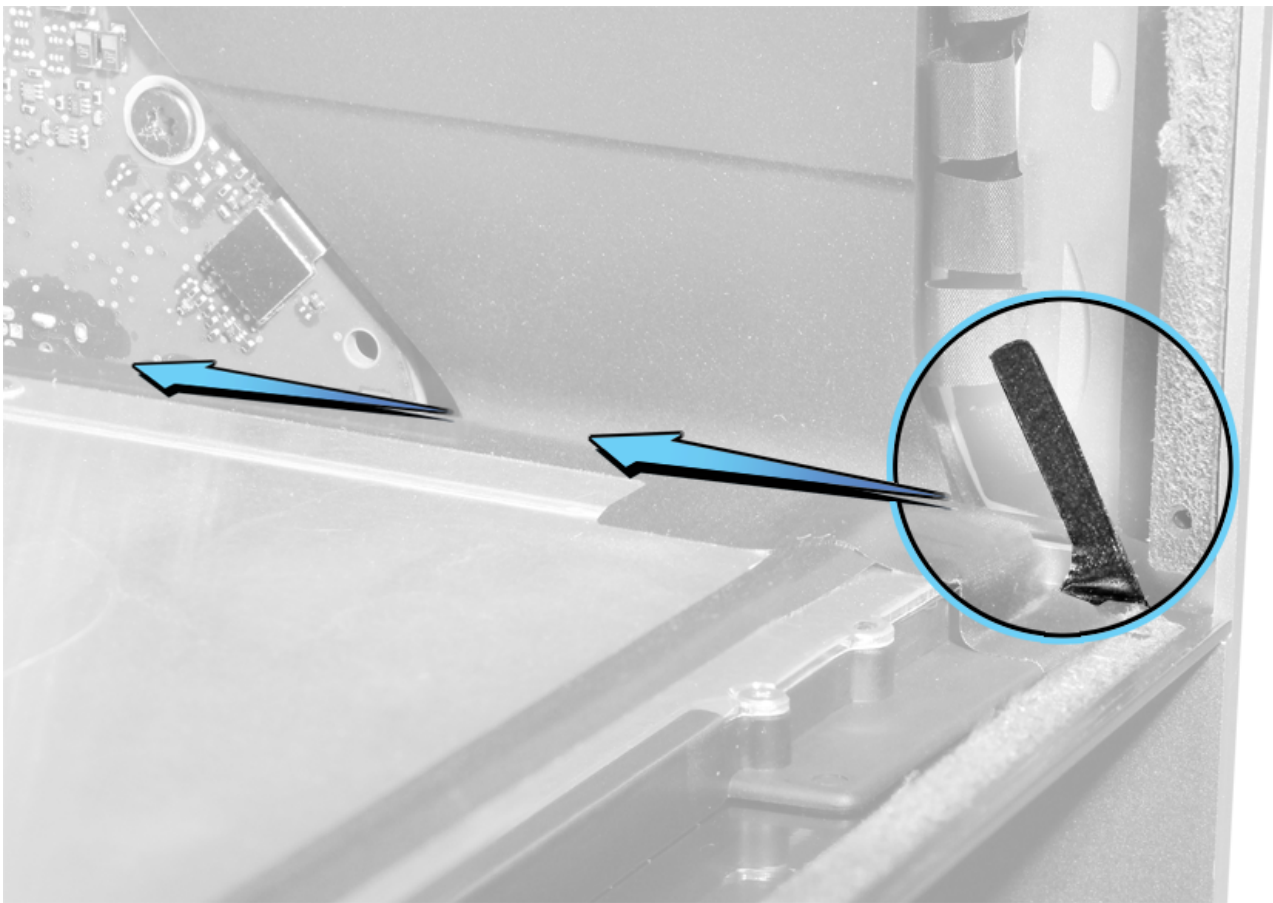
**Note:** The display backlight power cable is part of the display panel assembly and is not a separate part.





11. Lower the display panel (not shown). Locate the two VHB strips along the chin. Pull the VHB tab on each strip toward the center.





12. Gently pull the display panel off of the rear housing and store it in an ESD-safe bag.

**Note:** If the panel is sticking to the rear housing, use a black stick to carefully break the VHB bond between the display and the iMac rear housing. Be careful not to damage the black Mylar on the display. If the black protective Mylar is pulled from the display, the display panel may need to be replaced.



## Steps For Reassembly

Refer to the following articles:

- [RP998: Display Panel - Removing Very High Bond \(VHB\) Strips](#)
- [RP999: Display Panel - Replacing Very High Bond \(VHB\) Strips](#)
- [RP1000: Display Panel Reassembly](#)

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Display Panel - Removing Very High Bond (VHB) Strips

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV102: VHB Removal Video](#).

Before you begin:

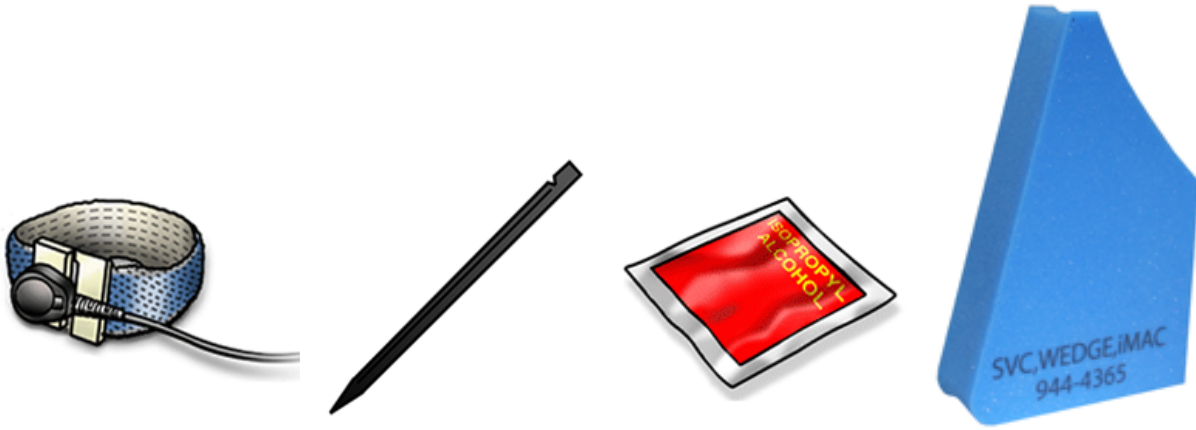
- [Display Panel Removal](#)



## Tools

- ESD wrist strap and mat
- Black stick
- Isopropyl alcohol (IPA) wipes
- Service wedge (iMac)

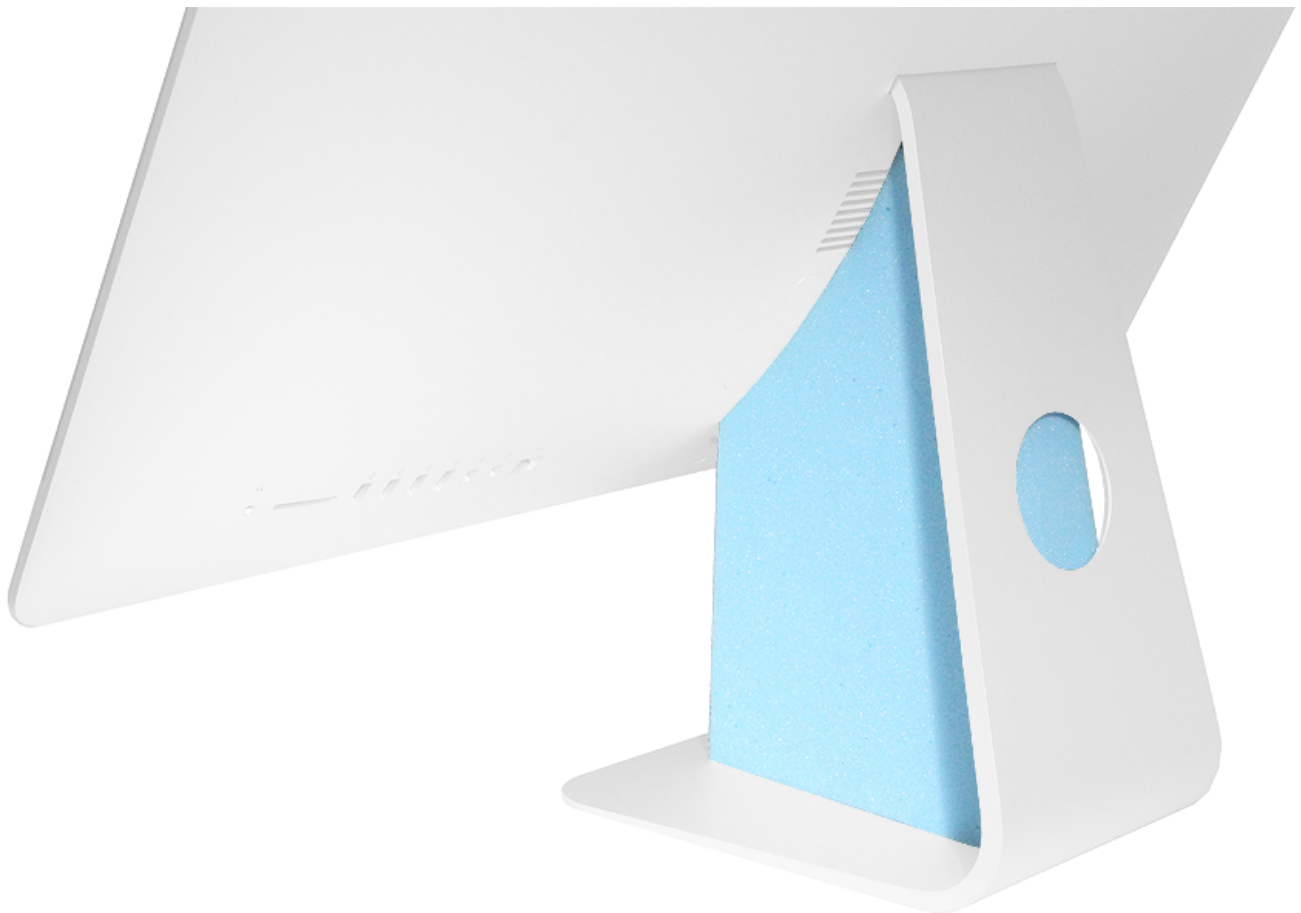




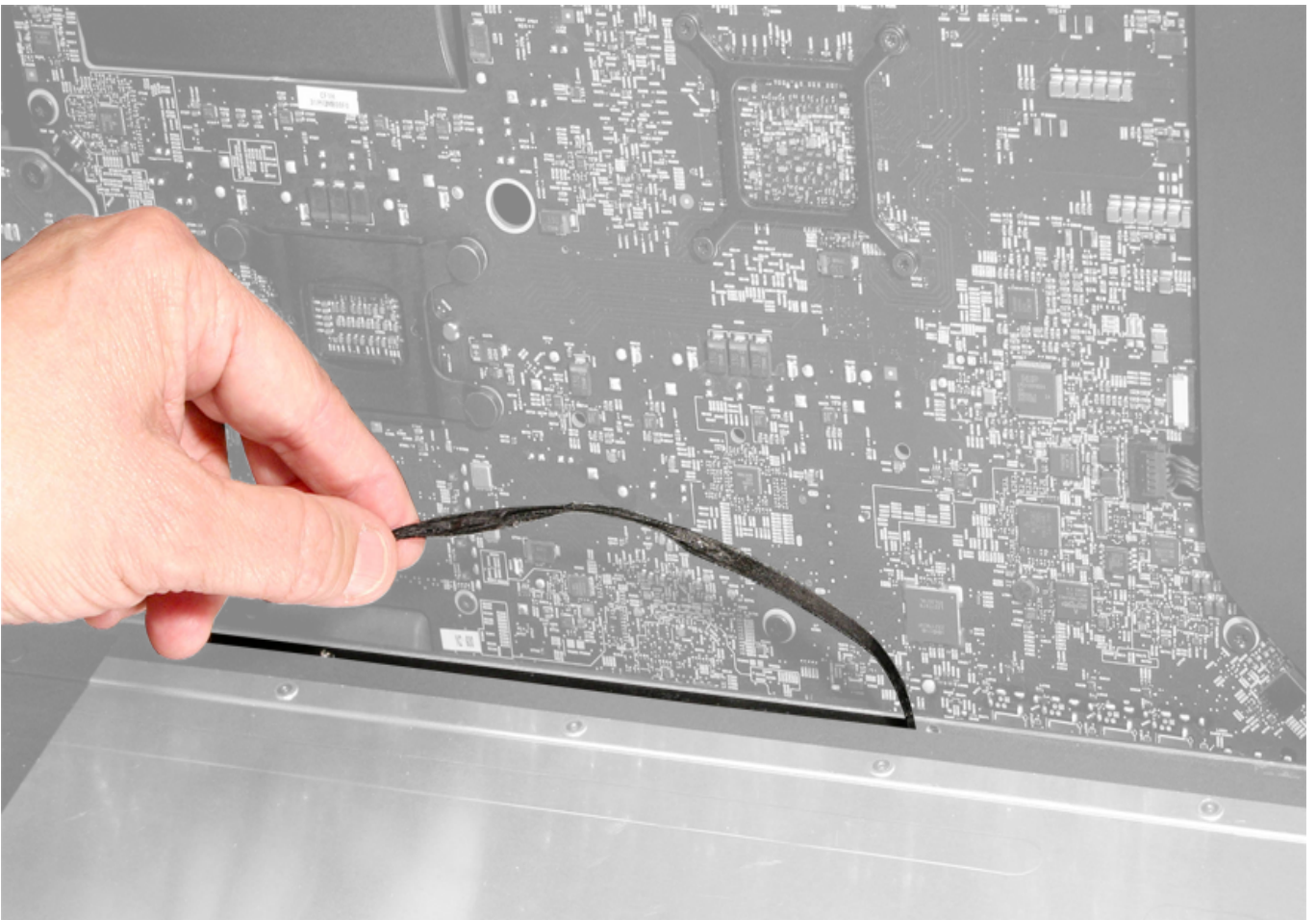
## Steps For Removal

**Note:** On the rare occasion that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Insert the service wedge to hold the display steady for this procedure. When positioned correctly, the service wedge covers the power receptacle.



2. Use your fingers and the flat end of a black stick to remove any residual Very High Bond (VHB) adhesive from the rear housing, antennas, and display panel.

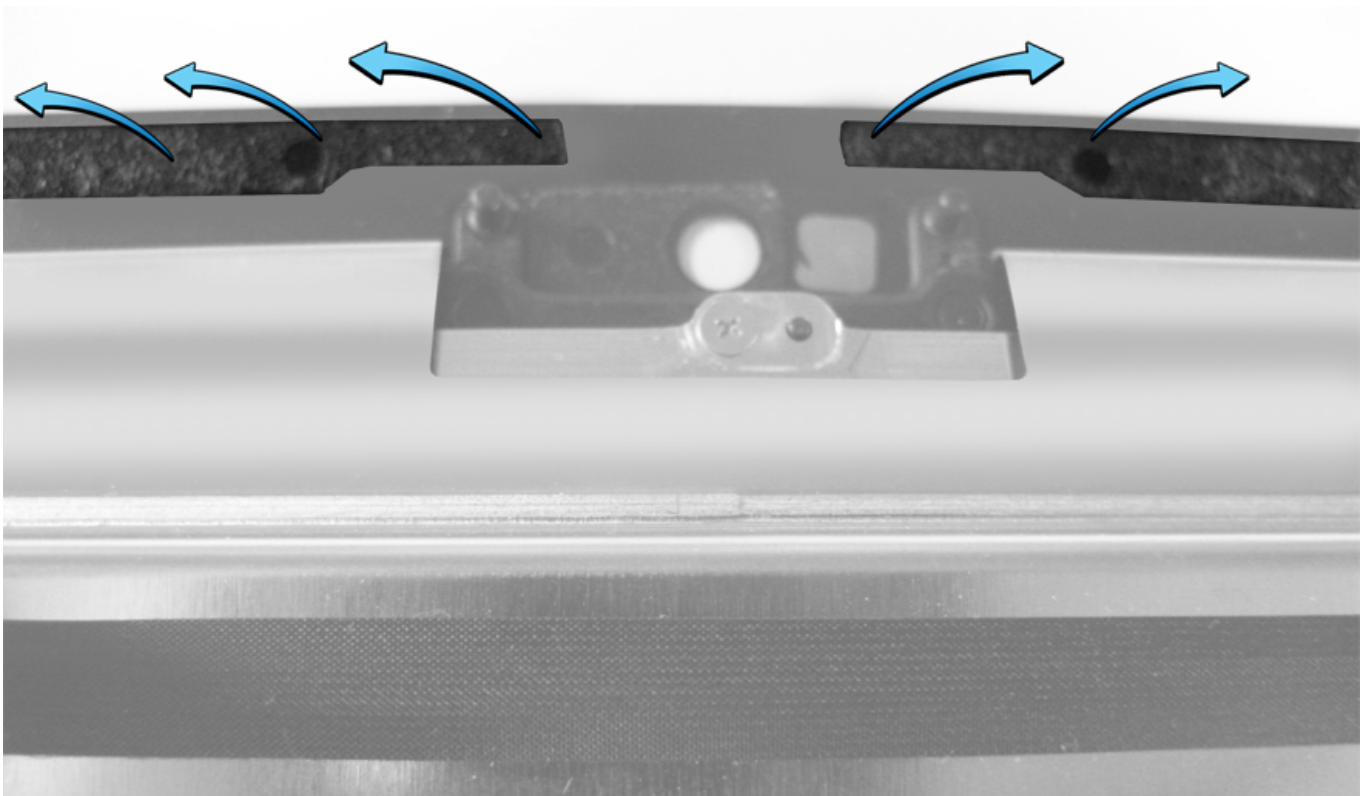


3. **Note:** Use caution when removing VHB from the display panel, to prevent damage to the black Mylar protective film that is located on the display panel glass. Ensure that you are peeling up the VHB and not the Mylar film. An easy way to ensure that you do not peel up the Mylar film on the display is to start peeling the VHB from the center points, not the ends of the display.

**Peeling VHB from the display panel:**

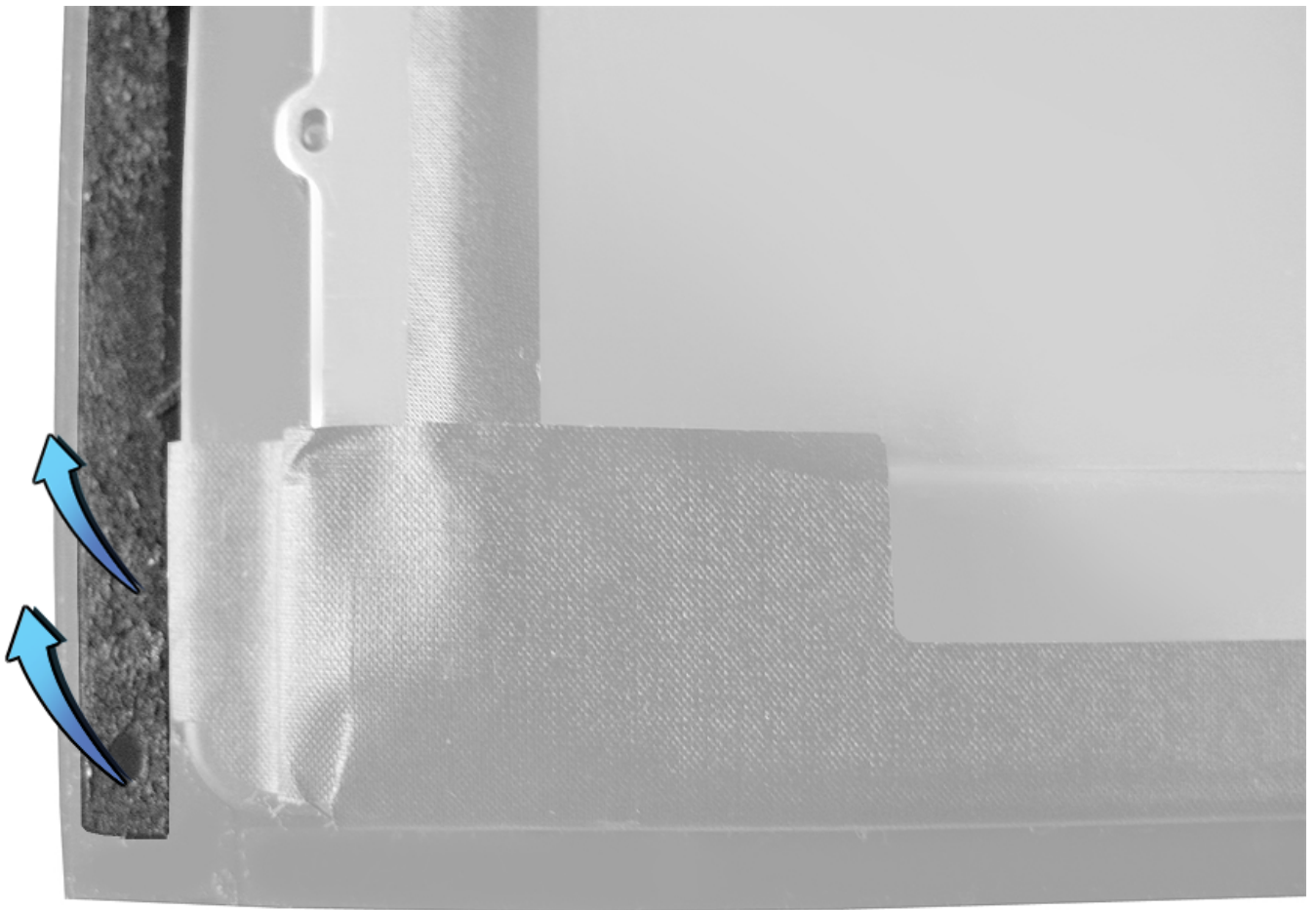


Top of display shown, peeling VHB to the left and right, above the camera module location.



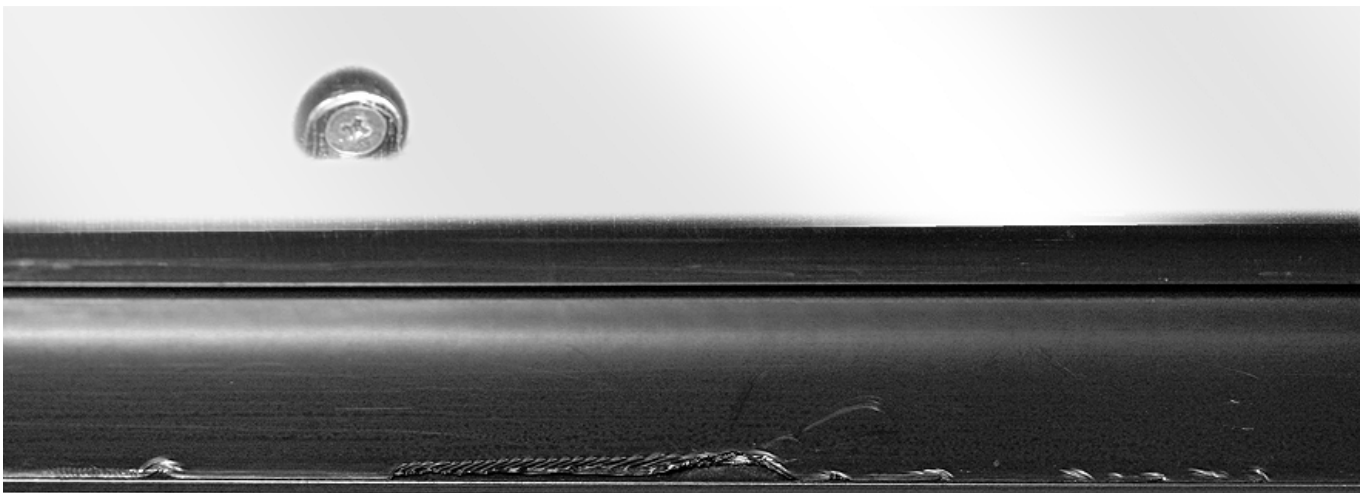
At the bottom corners of the display, peel the VHB upward.





If the black protective Mylar film is peeled or wrinkled on the display (as shown below), press the film back onto the panel with your finger. The Mylar should be smooth and undamaged. Use caution when working around the black Mylar protective film. If the Mylar is pulled from the display, the display panel may need to be replaced.

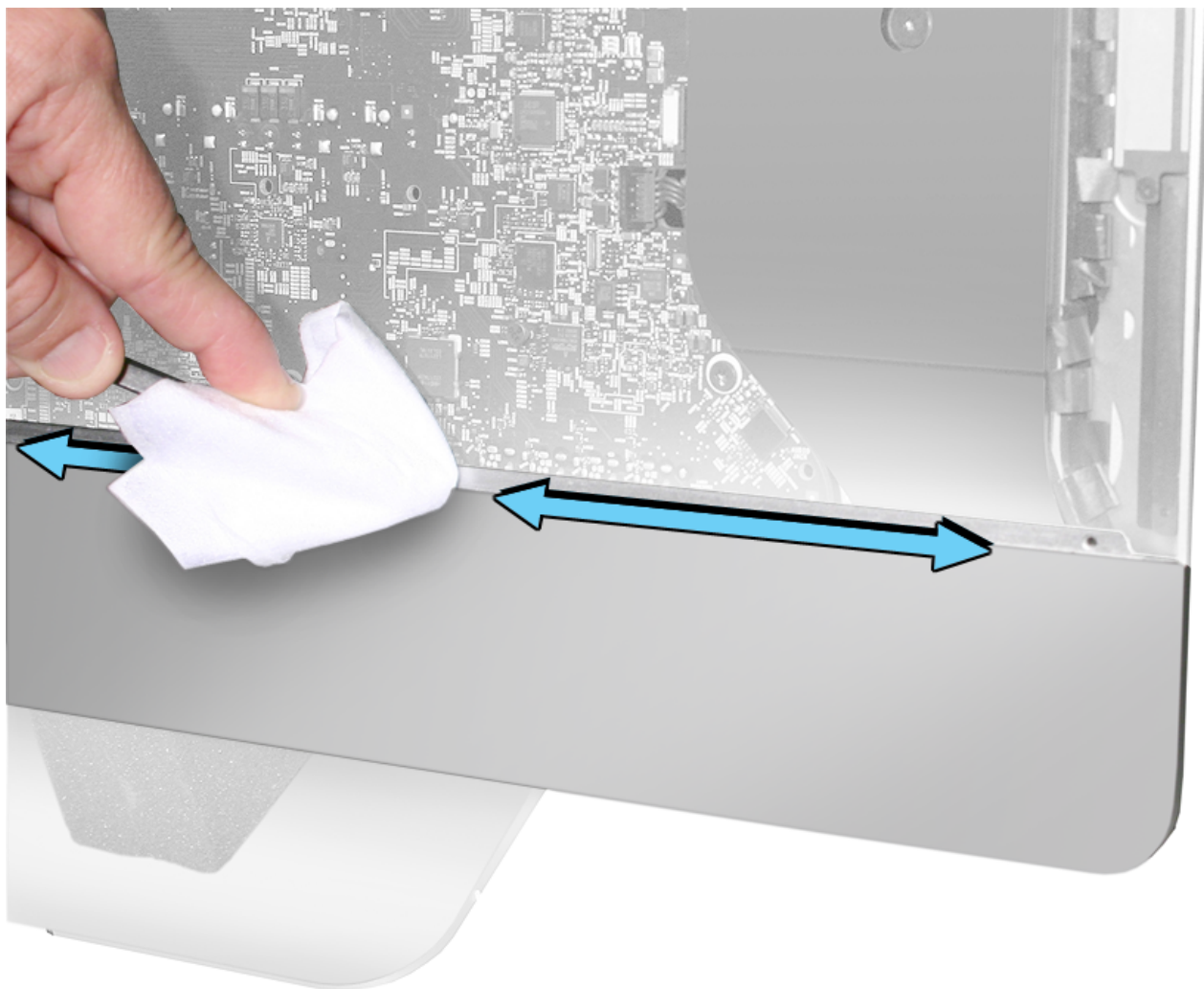
**Display panel Mylar damage:**



Do not peel VHB from the display corners. The chance of damaging the black Mylar protective film is greater if VHB removal is started in the corner.



4. Remove any remaining adhesive by wiping the rear housing and display panel edges clean with an IPA wipe. Continue until the surfaces no longer show VHB residue.







5. Allow the surfaces to dry for one (1) minute.

6. Check again to ensure that the display and rear housing are clean of VHB.

### **Steps For Reassembly**

Refer to the following articles:

- [RP999: Display Panel - Replacing Very High Bond \(VHB\) Strips](#)
- [RP1000: Display Panel Reassembly](#)

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Display Panel - Replacing Very High Bond (VHB) Strips

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV115: VHB Installation Video](#).

Before you begin:

- [Display Panel Removal](#)
- [Display Panel - Removing Very High Bond \(VHB\) Strips](#)



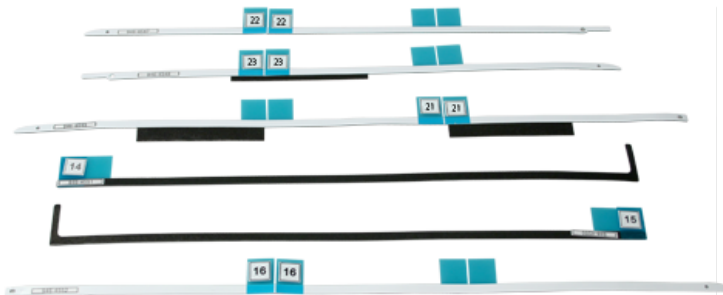
## Tools

- ESD wrist strap and mat
- Black stick
- Service wedge (iMac)
- Display removal tool
- iMac (27-inch, Late 2012 and Late 2013) display refill kit, VHB strips, package of 20 (076-1419)
- iMac (Retina 5K, 27-inch, Late 2014) display refill kit, VHB strips, package of 20 (076-00009)





iMac (Retina 5K, 27-inch, Late 2014) VHB strips:

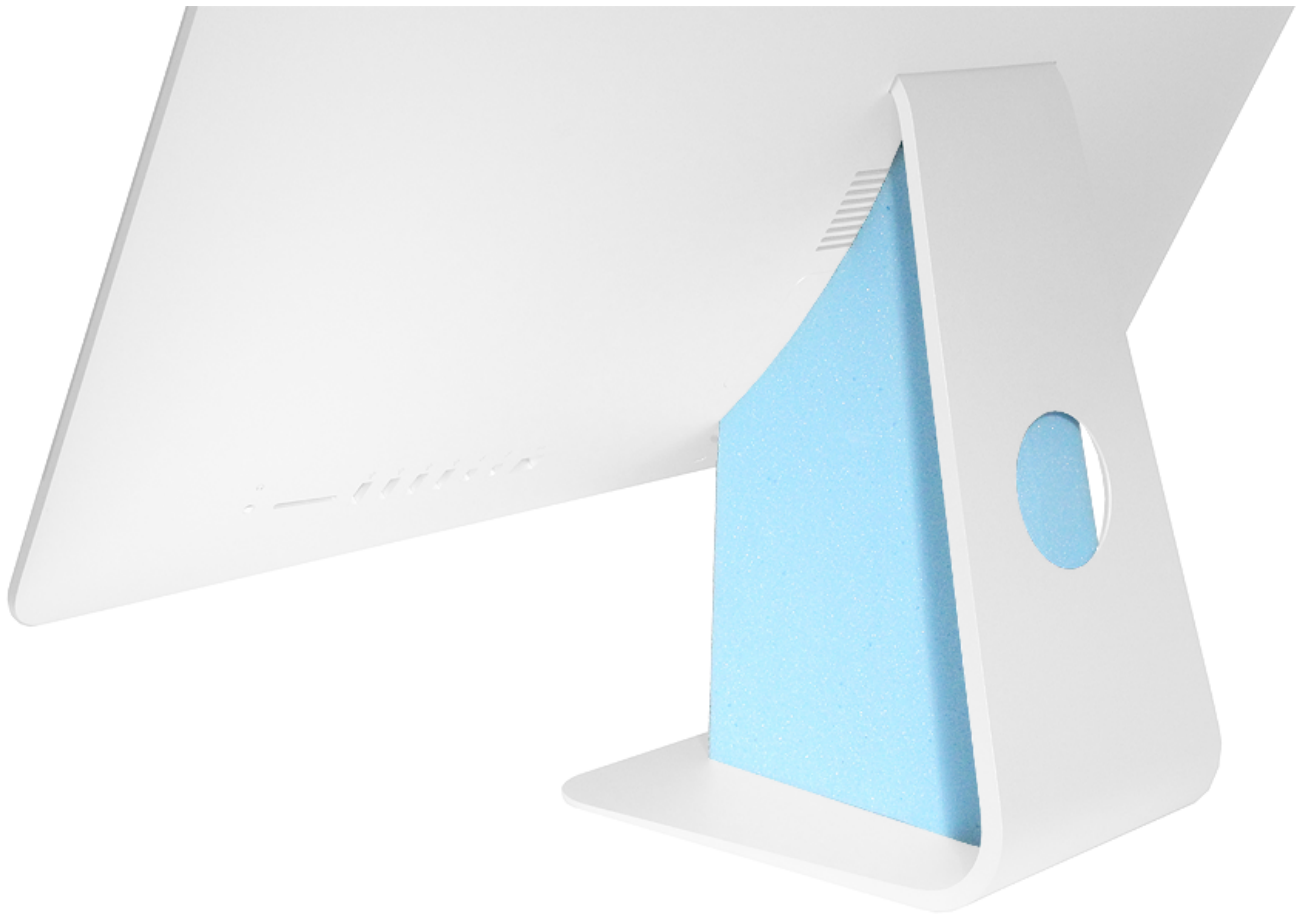


## Steps For Removal

This is a reassembly instruction article. For removal steps, see [RP998: Display Panel - Removing Very High Bond \(VHB\) Strips.](#)

## Steps For Reassembly

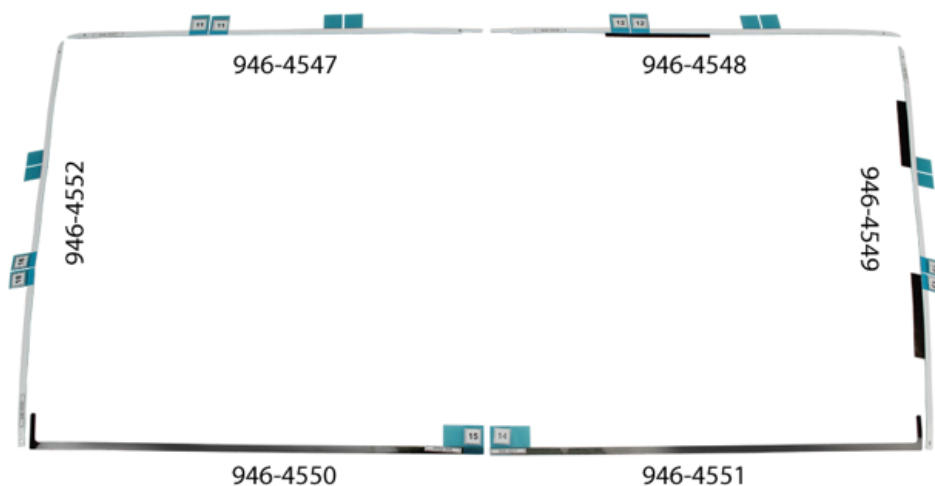
1. Insert the service wedge to hold the display steady. When positioned correctly, the wedge covers the power receptacle. Rotate the computer so the display panel is facing you.



2. Each VHB strip has an ID number (on the pull tab) and part number (beginning with 946) printed on the strip. Use the tables and pictures below to verify that you have all of the needed VHB strips. Lay out the VHB strips before installing them onto the computer and check them for damage. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues, make the display bond weak, or create light leakage.

**iMac (27-inch, Late 2012 and Late 2013) VHB strips:**

VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	11	946-4547
Top right	12	946-4548
Right side	13	946-4549
Bottom right	14	946-4551
Bottom left	15	946-4550
Left side	16	946-4552

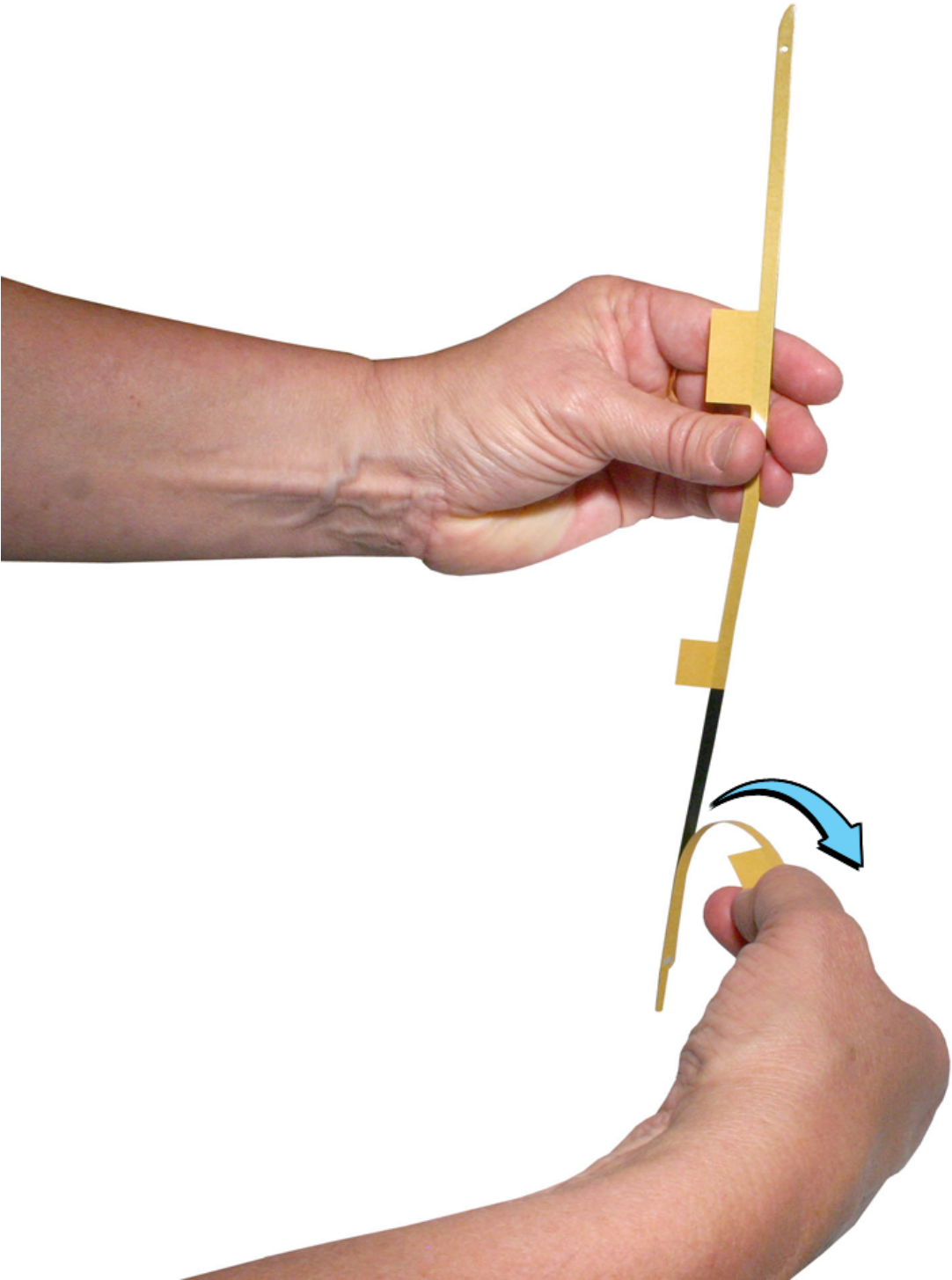


iMac (Retina 5K, 27-inch, Late 2014) VHB strips:

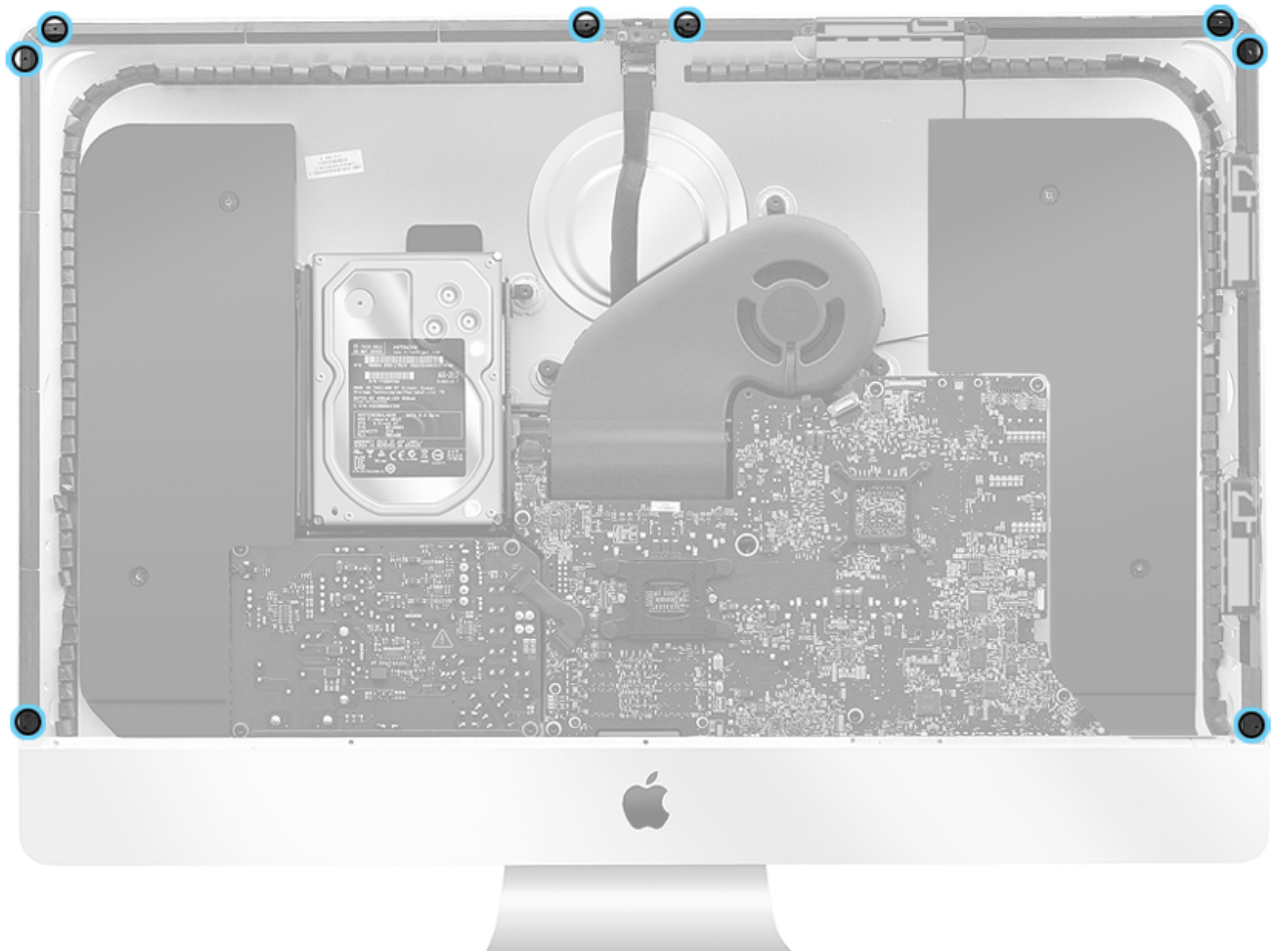
VHB Strip Description	VHB Strip ID Number	Part Number on VHB Strip
Top left	22	946-01031
Top right	23	946-01033
Right side	21	946-01032
Bottom right	14	946-4551
Bottom left	15	946-4550
Left side	16	946-4552



3. The VHB strips have a foam layer (VHB/foam/VHB), with a removable paper liner on the underside and a clear plastic liner on the top side. The image below shows the process of peeling the paper liner off the underside of the VHB strip.

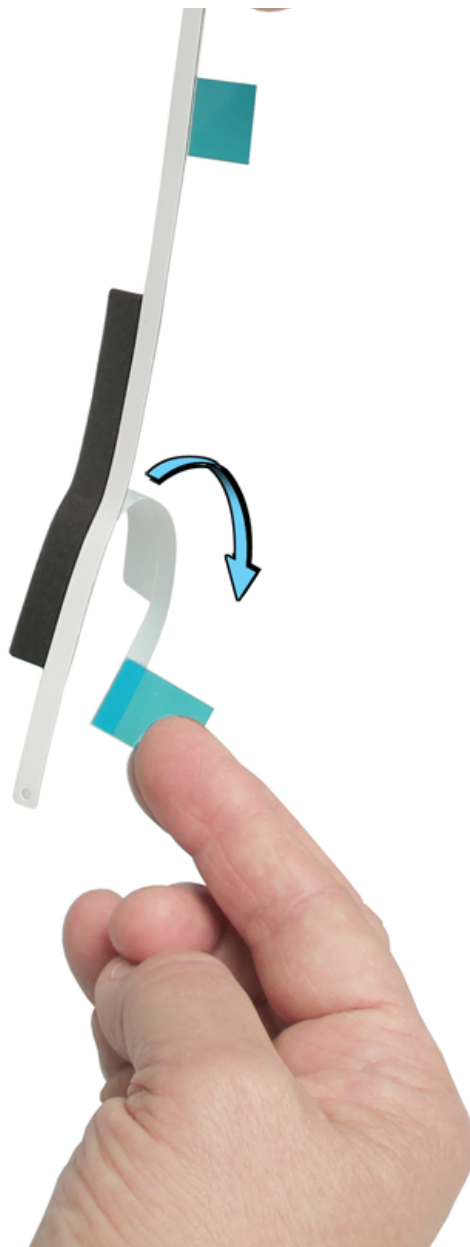


4. The rear housing has eight (8) alignment holes. Use them to align the new VHB strips. **Note:** Before adhering the VHB strips and installing the display, verify that all the internal cables are connected and all screws are installed.



5. Peel the paper backing off of one portion of the VHB strip. **Note:** The more recent VHB strips are a teal blue color. Some of the procedures that follow show older VHB strips, which are an orange color. The replacement VHB process is the same regardless of color.





6. Use the pointed end of a black stick to align the VHB strips on the rear housing. **Note:** The paper liner side faces the rear housing.

7. As you position the VHB, use your finger to peel the remaining paper liner from the underside of the VHB strip.

8. Use your finger to press the VHB strip into place on the rear housing. **Note:** If a VHB strip does not line up correctly, remove it and start again.

9. Do not remove the clear plastic liners from the top layer of the strip at this time. Remove them right before you replace the panel.



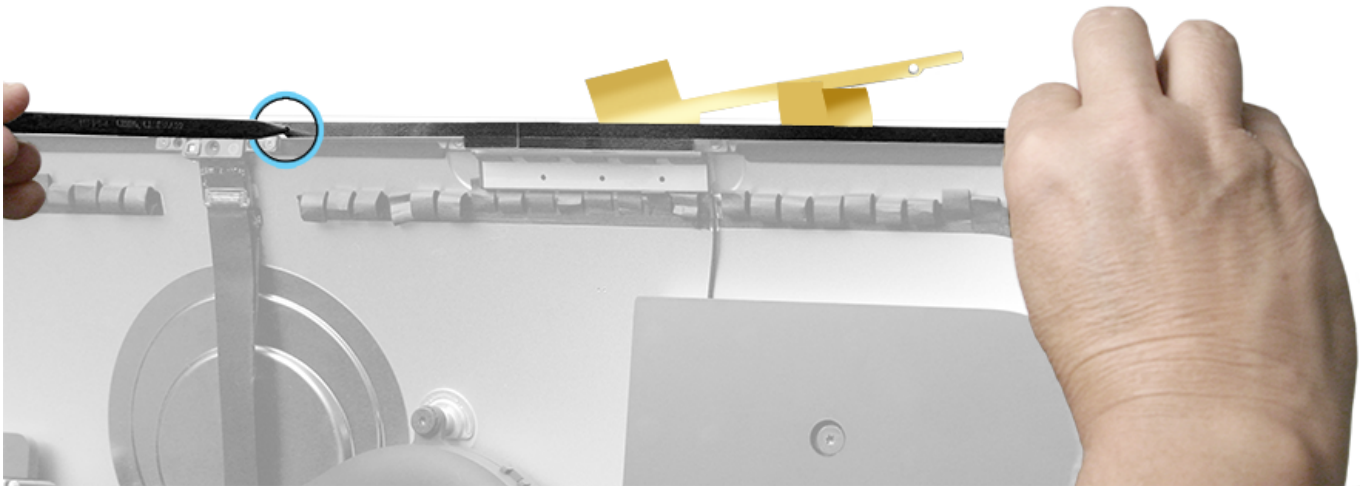
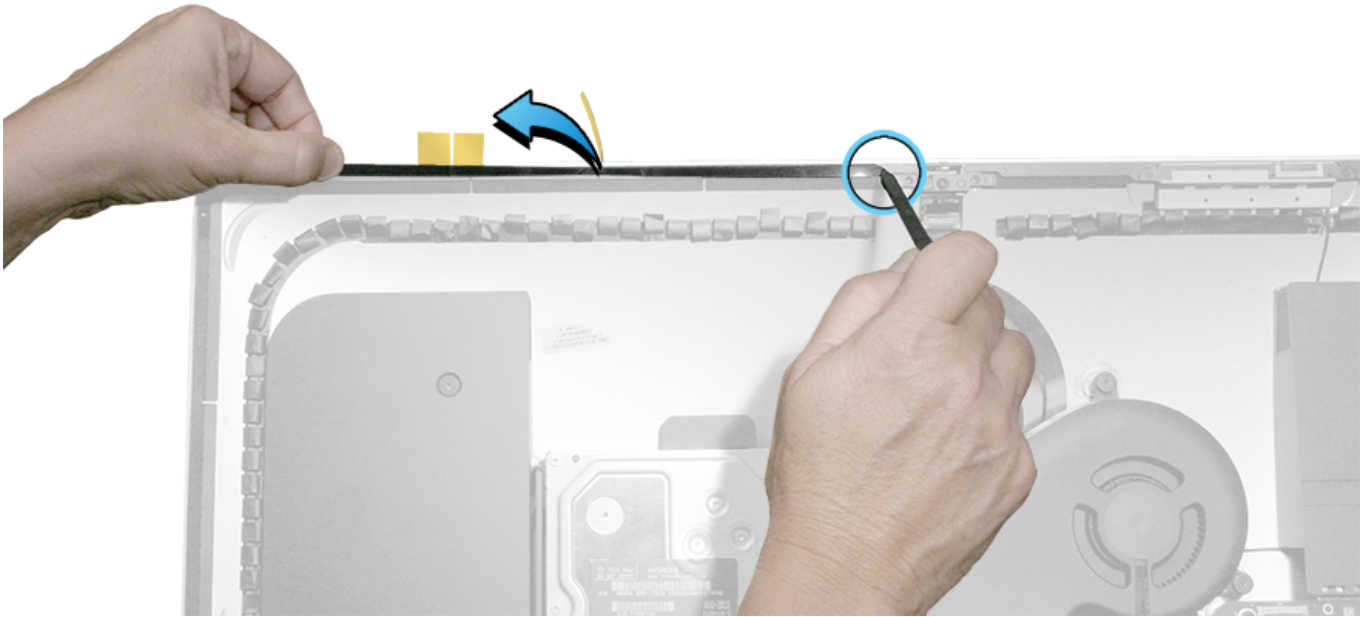
10. Insert the pointed end of a black stick into another alignment hole and peel the paper backing off of the strip. Press down with your finger to adhere the strip to the rear housing.



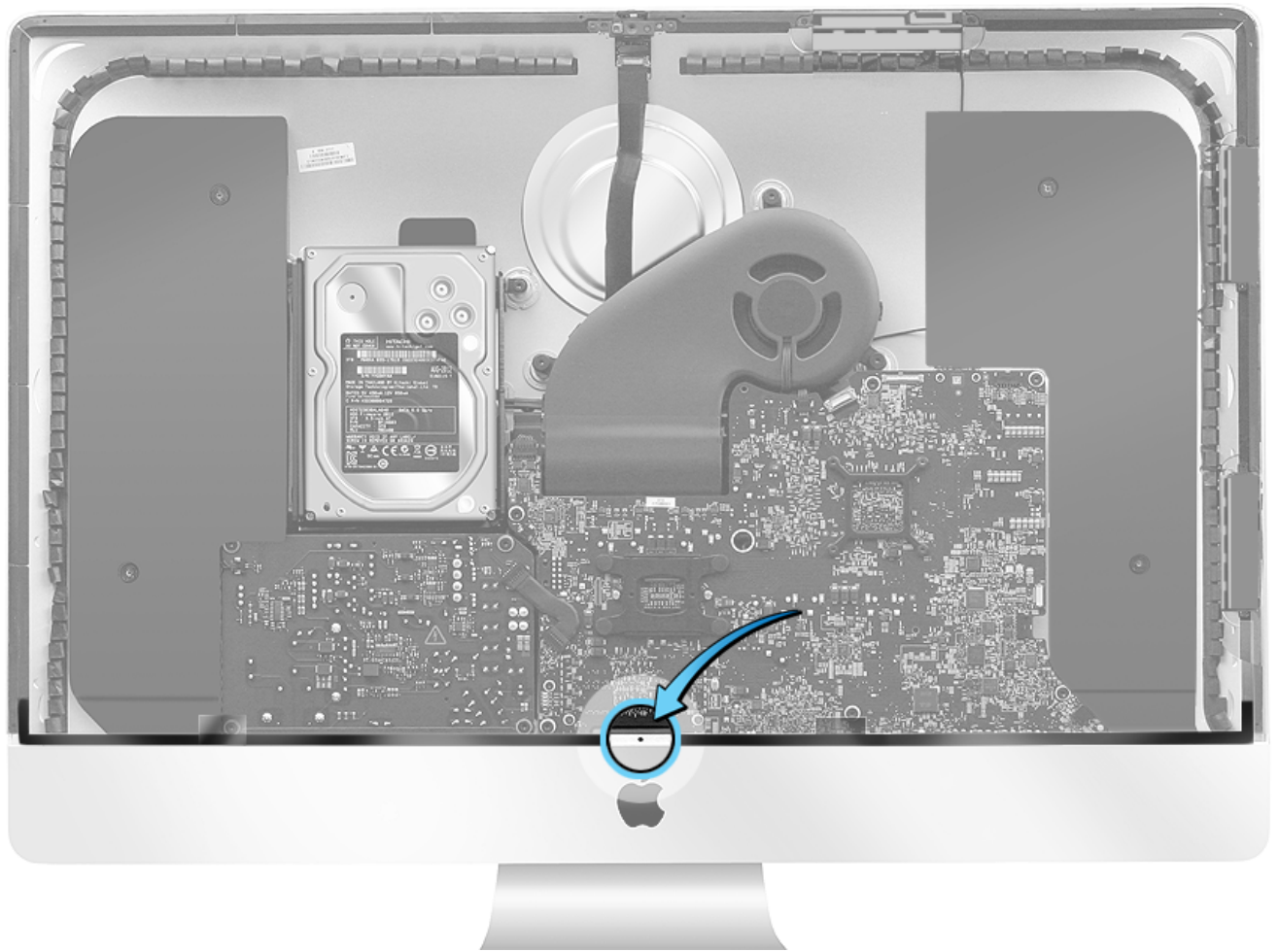


11. Repeat the VHB process (align, peel paper liners, press VHB into place) along the top edge of the rear housing. Press with your fingers to adhere the strips to the rear housing.





12. Start in the center of the chin (the bottom edge) and position the VHB strips to the left and right of the center screw hole (as shown). The angled end of the VHB strip should attach to the rear housing, and should not overlap the VHB strips on the sides.



13. **Note:** If any VHB strip does not line up correctly, remove it, clean the rear housing, and start again. Check that there are no wrinkles or exposed sections on the strip. Damage can cause cosmetic gap issues and may make the display bond weaker or create light leakage.

14. To install the display panel, refer to [RP1000: Display Panel Reassembly](#).

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Display Panel Reassembly

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV117: Display Panel Replacement Video](#).

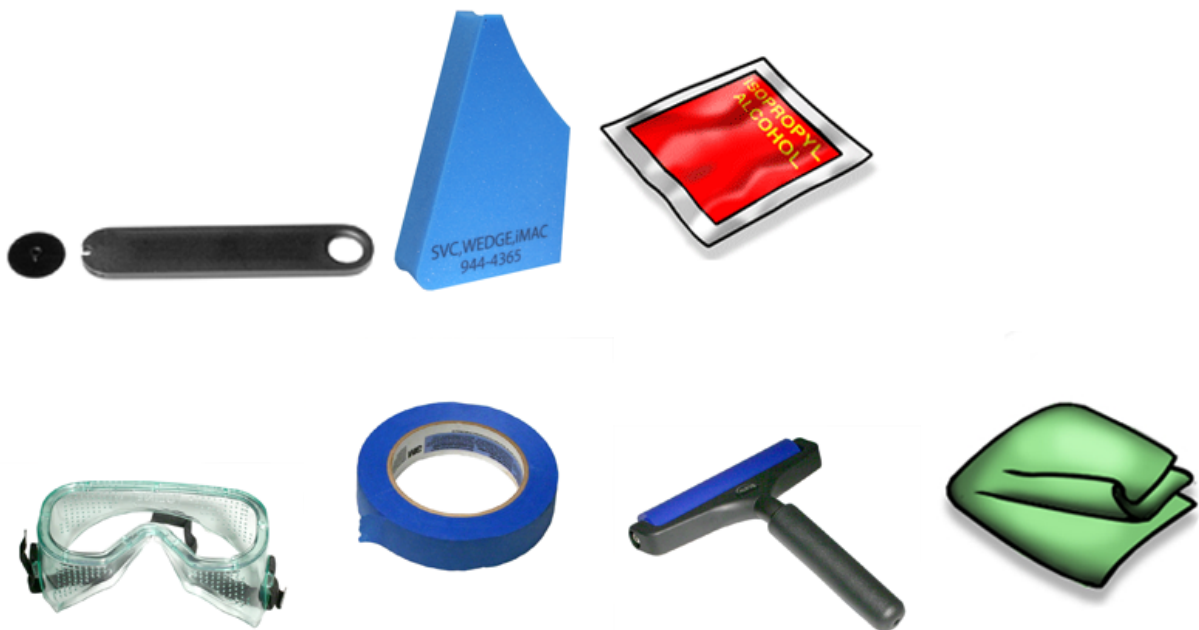
Before you begin:

- [Display Panel Removal](#)
- [Display Panel - Removing Very High Bond \(VHB\) Strips](#)
- [Display Panel - Replacing Very High Bond \(VHB\) Strips](#)



## Tools

- Display removal tool
- Service wedge (iMac)
- Isopropyl alcohol (IPA) wipes (to remove residual VHB adhesive)
- Safety glasses
- Painter's tape (tape that does not leave a residue, 1–2 inches wide, preferably 2 inches, if available)
- Silicone display roller
- Clean, damp, lint-free cloth (to clean display panel glass)



## Steps For Removal

This is a reassembly instruction article. For removal steps, refer to the following Apple Support articles:

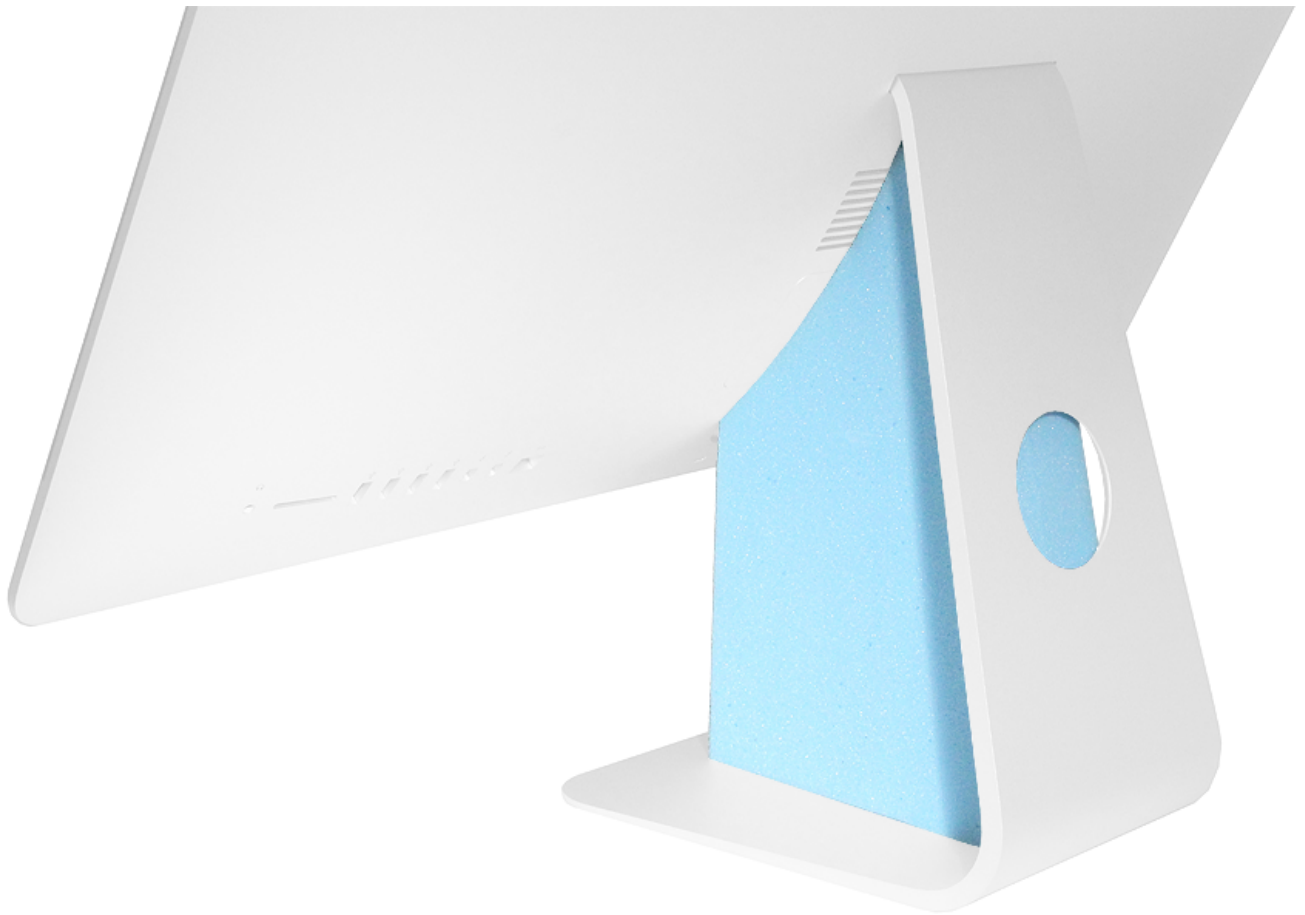
- [RP950: Display Panel Removal](#)
- [RP998: Display Panel - Removing Very High Bond \(VHB\) Strips](#)
- [RP999: Display Panel - Replacing Very High Bond \(VHB\) Strips](#)

If you have already performed the tasks listed above, proceed to the next step.

## Steps For Reassembly

**Note:** In the unlikely event that the display glass cracks or breaks, refer to article [TP819: Cleaning and Handling a Broken Display Panel](#).

1. Insert the service wedge to hold the display steady for this procedure. When positioned correctly, the wedge covers the power receptacle.



2. Before installing, ensure that any residual VHB is removed from the display panel and rear housing.



3. Place the display panel on the chin of the rear housing. Align the panel and check that it is centered and seated.





4. Use the display removal tool to check the alignment on both sides of the display. Adjust if necessary.



5. Anchor the display with a strip of painter's tape. Place it over the bottom of the display and the edge of the rear housing.





6. Stand back to check the alignment of the display panel. If the rear housing can be seen, adjust the panel and check again.

**INCORRECT ALIGNMENT**



**CORRECT ALIGNMENT**



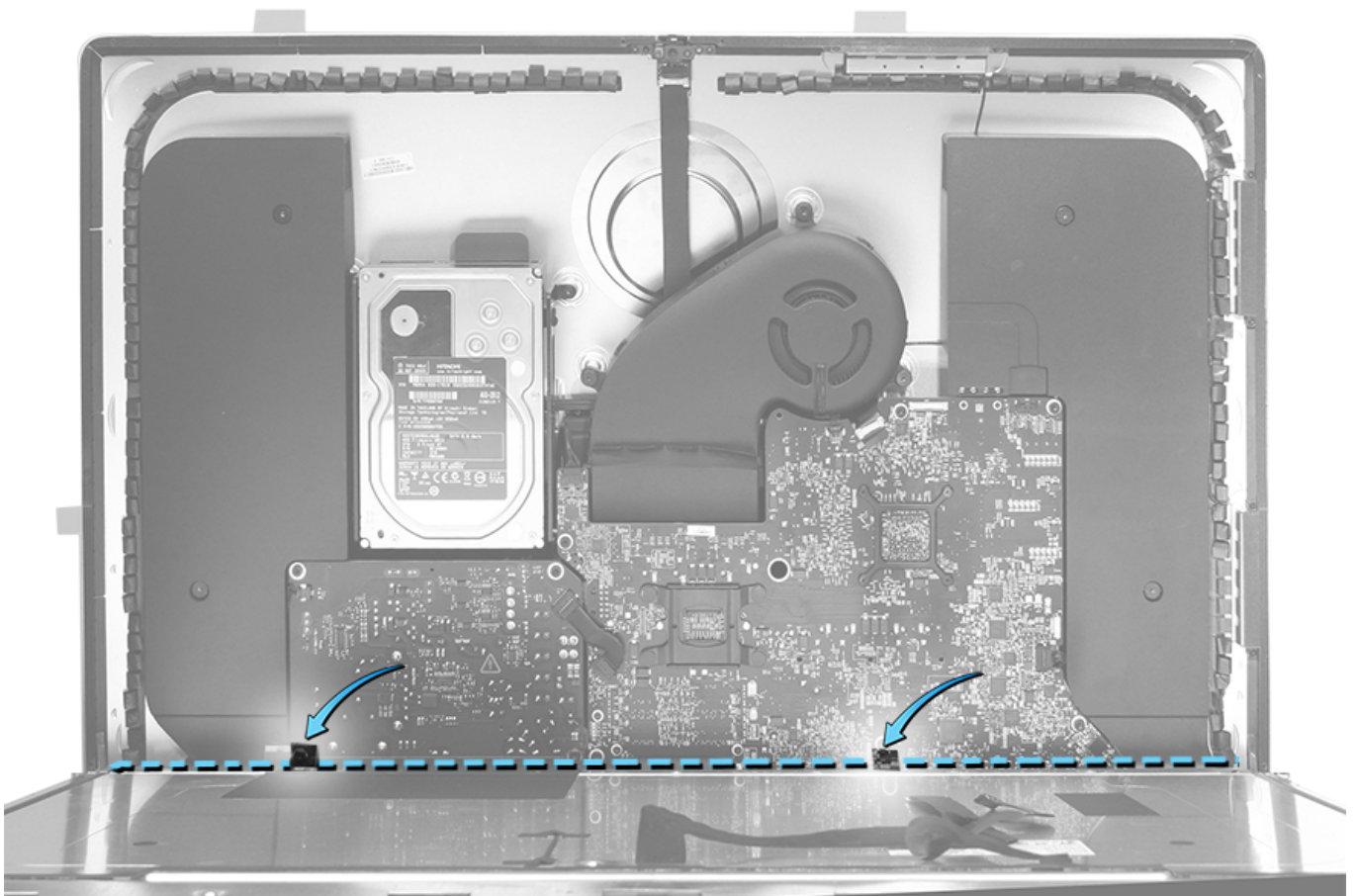
7. Anchor the display further with more strips of painter's tape. Place one or two vertical pieces along the edge for added support.



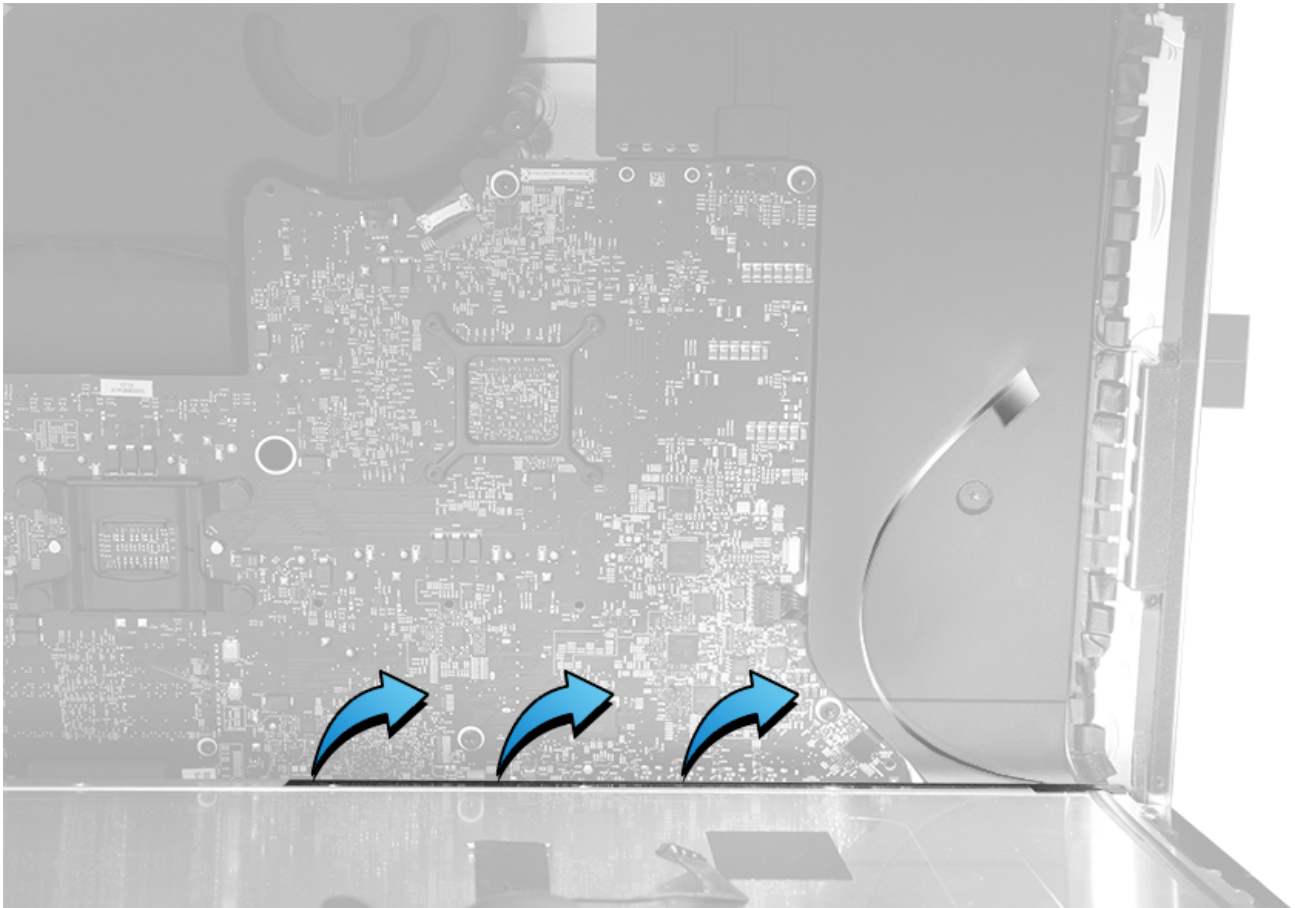
8. Use one hand to tilt the display forward.



9. Use the other hand to pull the clear release liners on the bottom VHB strips. Pull the release liners carefully so they do not tear or break.

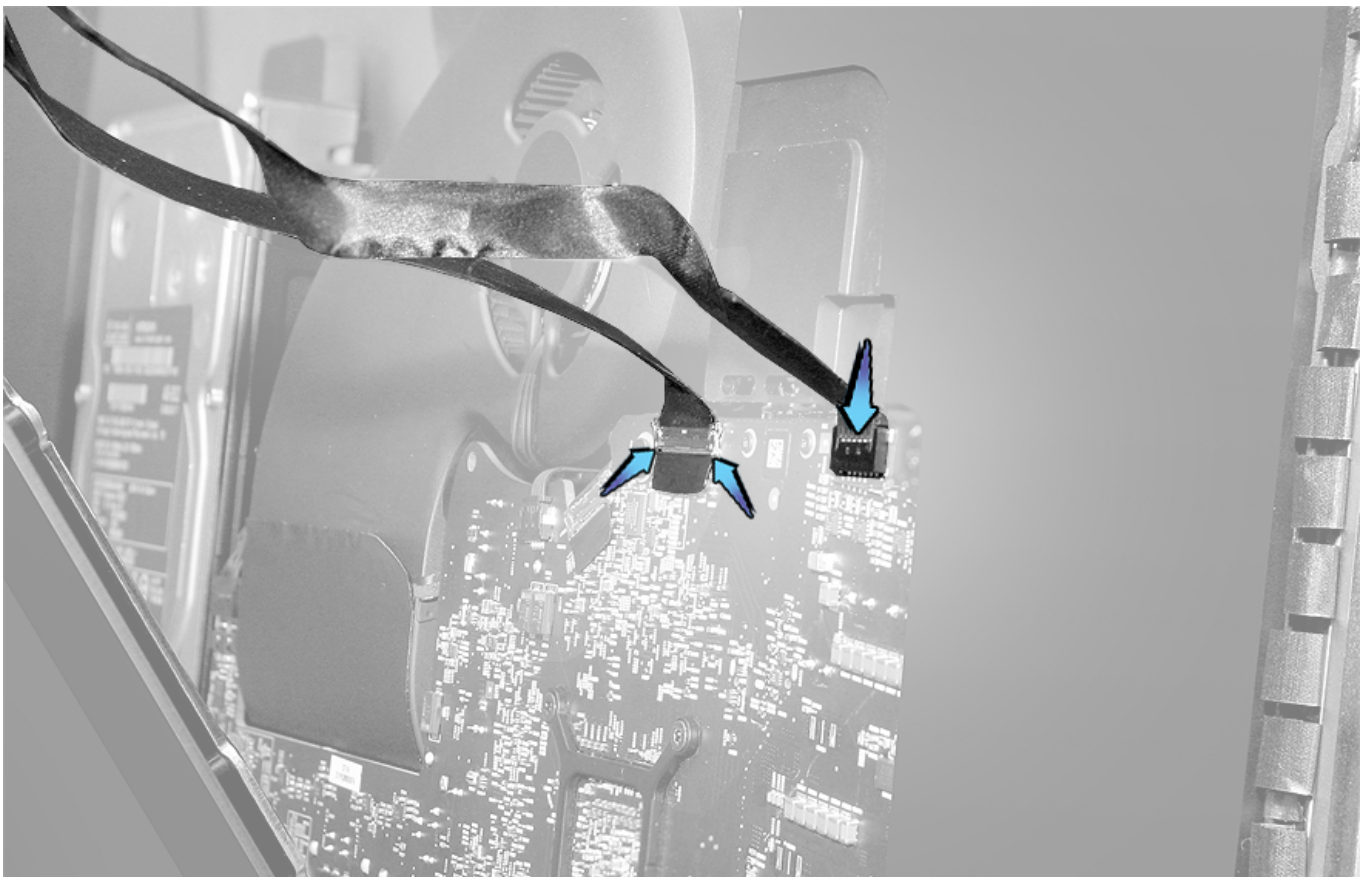


A closer view of the bottom release liner:



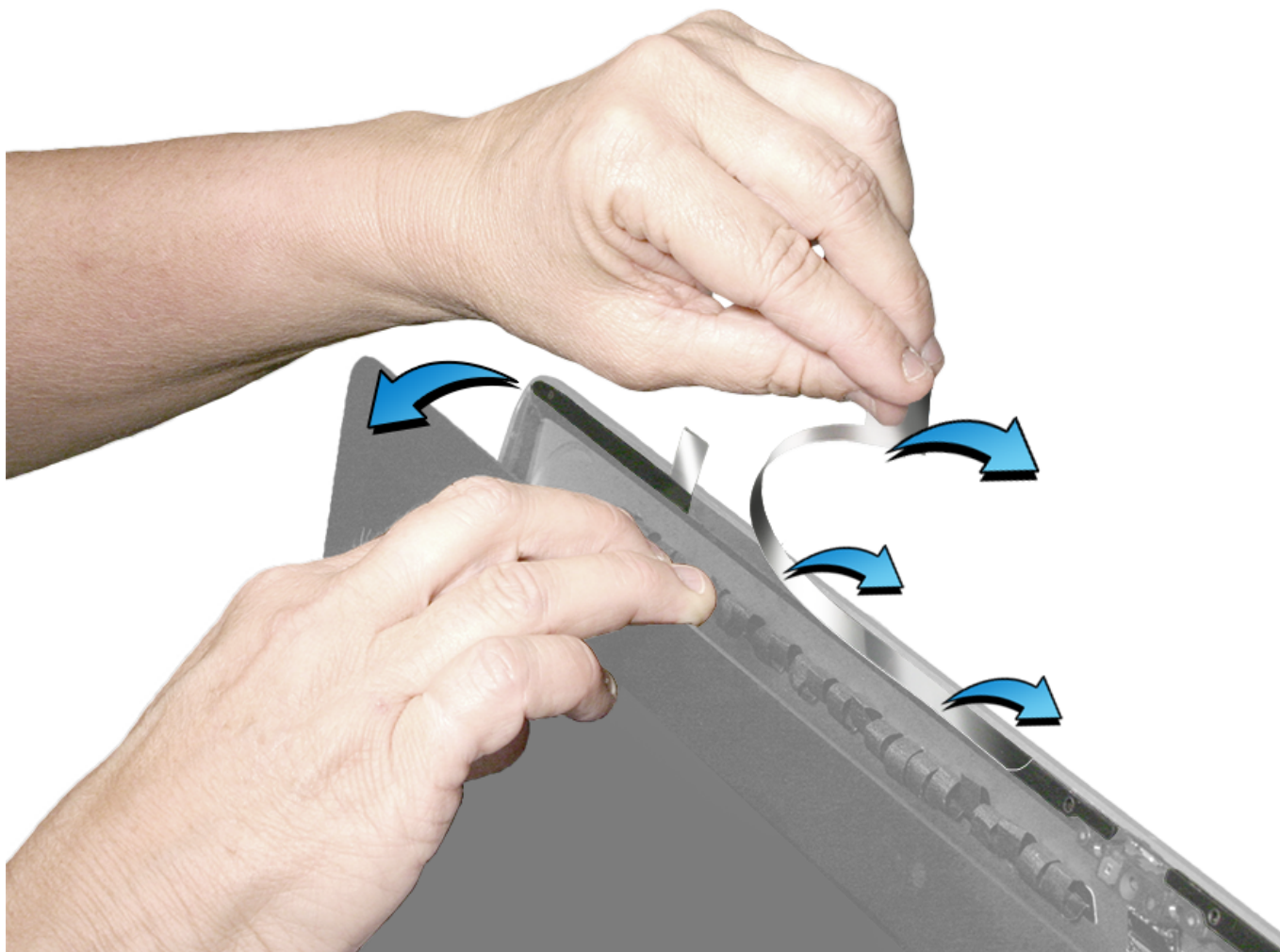
10. Tilt the display up, leaving enough room to connect the display power and Embedded DisplayPort (eDP) cables to the logic board. If these cables are not connected properly, it could result in no video or no power. Check that the connectors are firmly seated.

**Important: Be extremely careful not to stress the display cables and connectors on the logic board when tilting the display open. The display connectors on the logic board are easily damaged. If the connectors are damaged, the logic board will need to be replaced.**

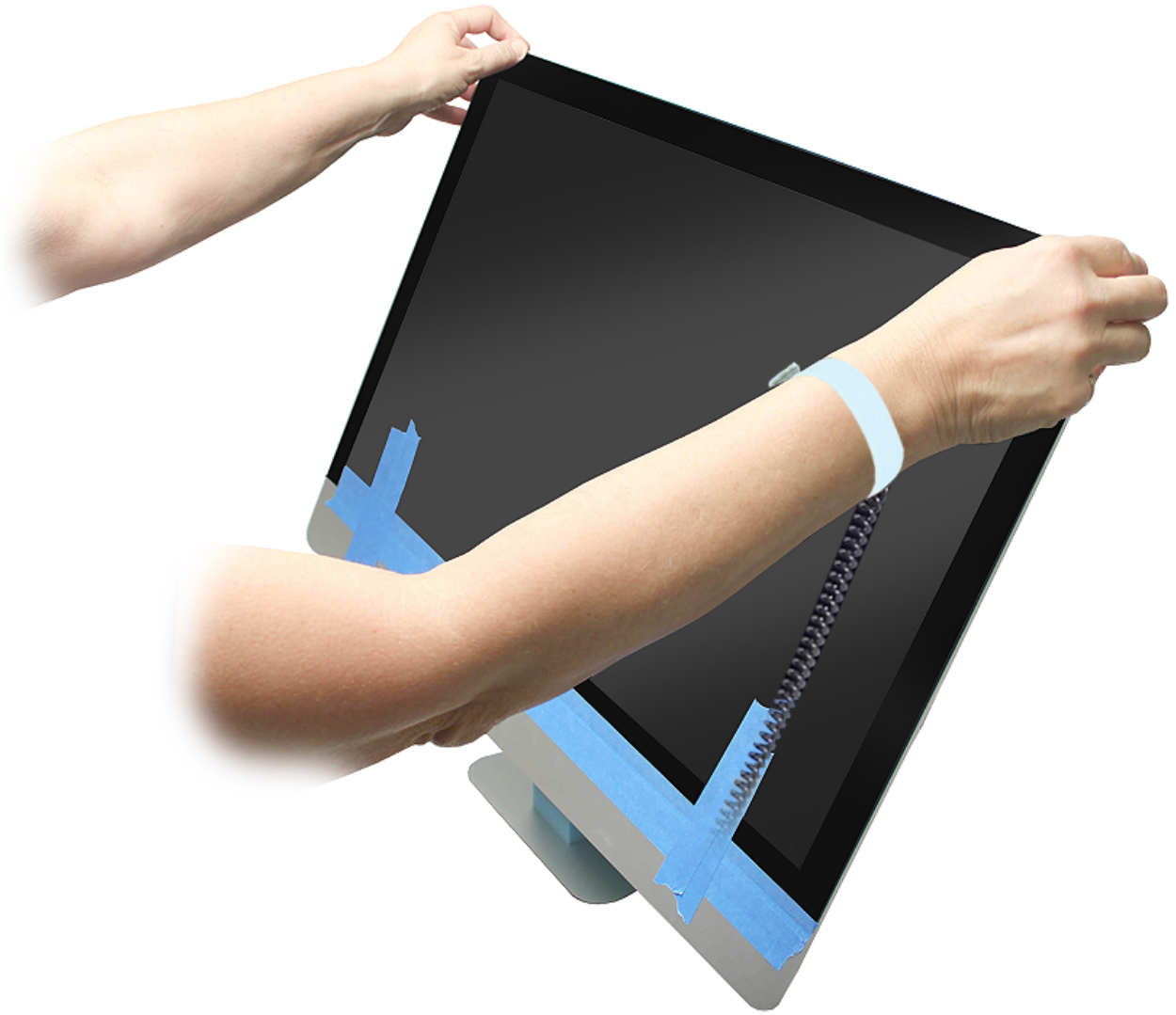




11. Remove the remaining release liners from the top and sides of the display panel.

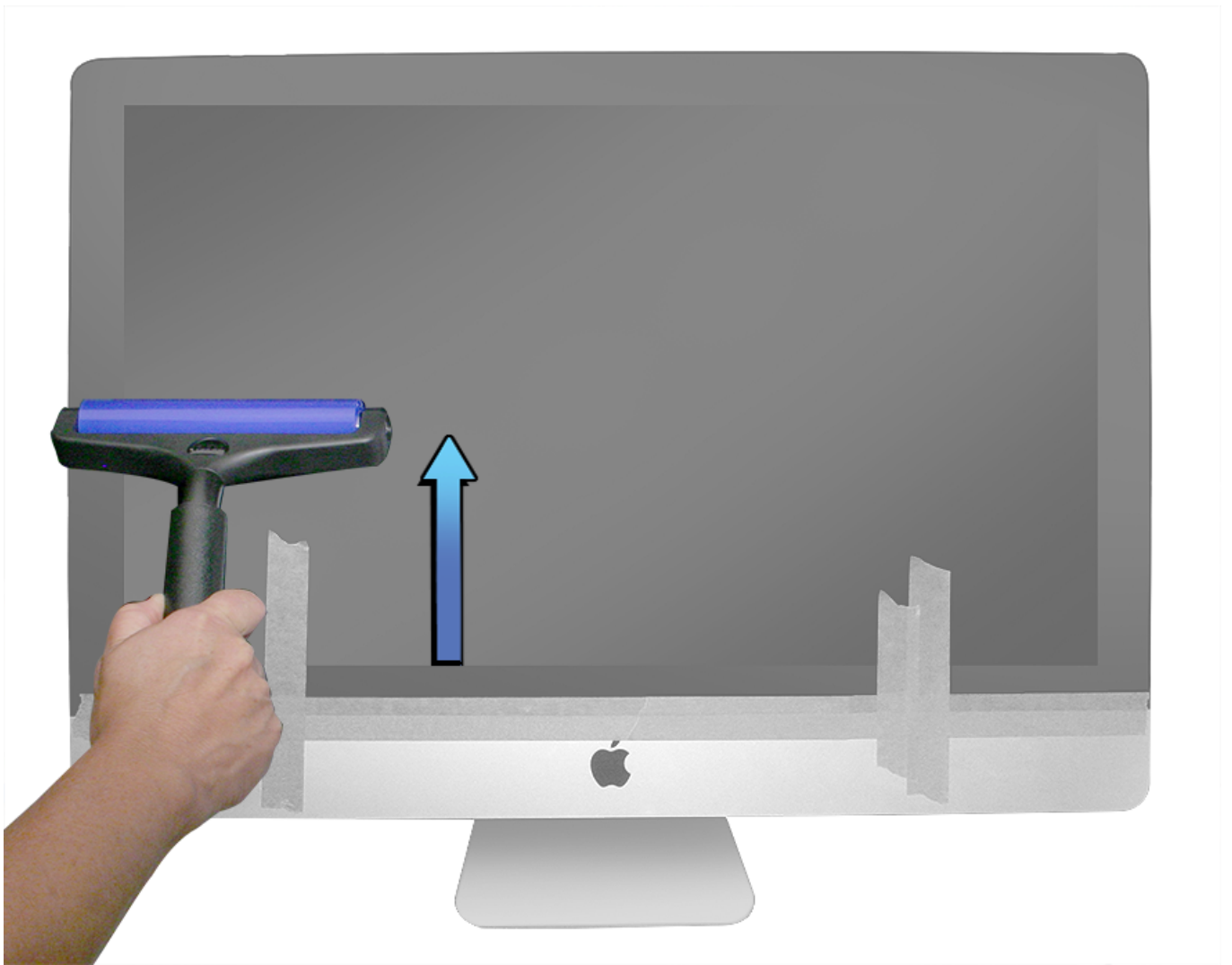


12. After all the release liners have been removed, lower the display panel against the rear housing.



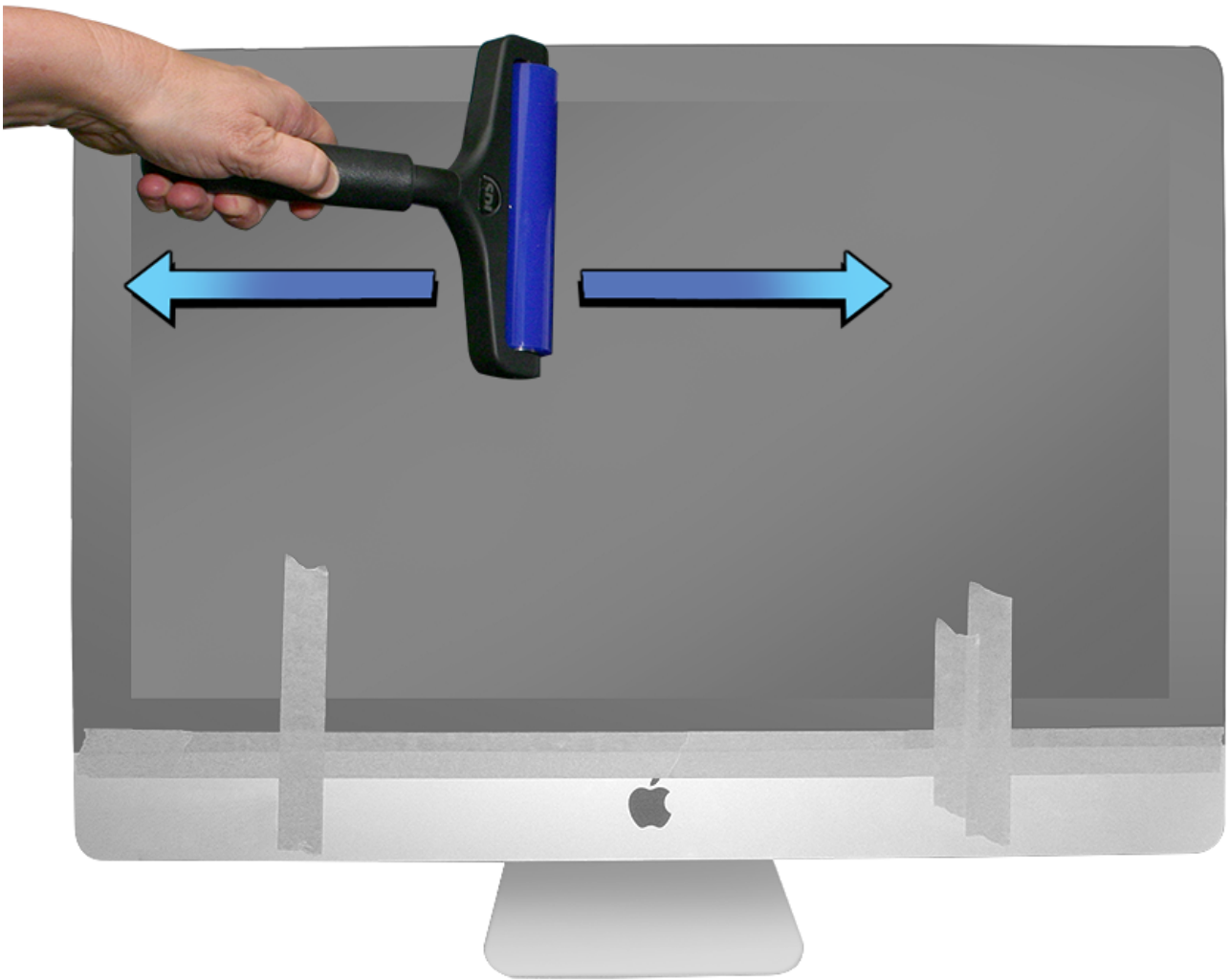
13. Use the silicone display roller to adhere the VHB strips to the glass. Roll the edges of the glass panel from the bottom to the top.

**Note:** Do not roll up and down.



Repeat the rolling along the top and the other side.





14. Remove the painter's tape.



15. Clean the front of the display with a clean, damp, lint-free cloth.

**Note:** Do not use IPA wipes to clean the display. IPA wipes should only be used to remove residual VHB adhesive.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Embedded DisplayPort Cable (eDP)

## First Steps

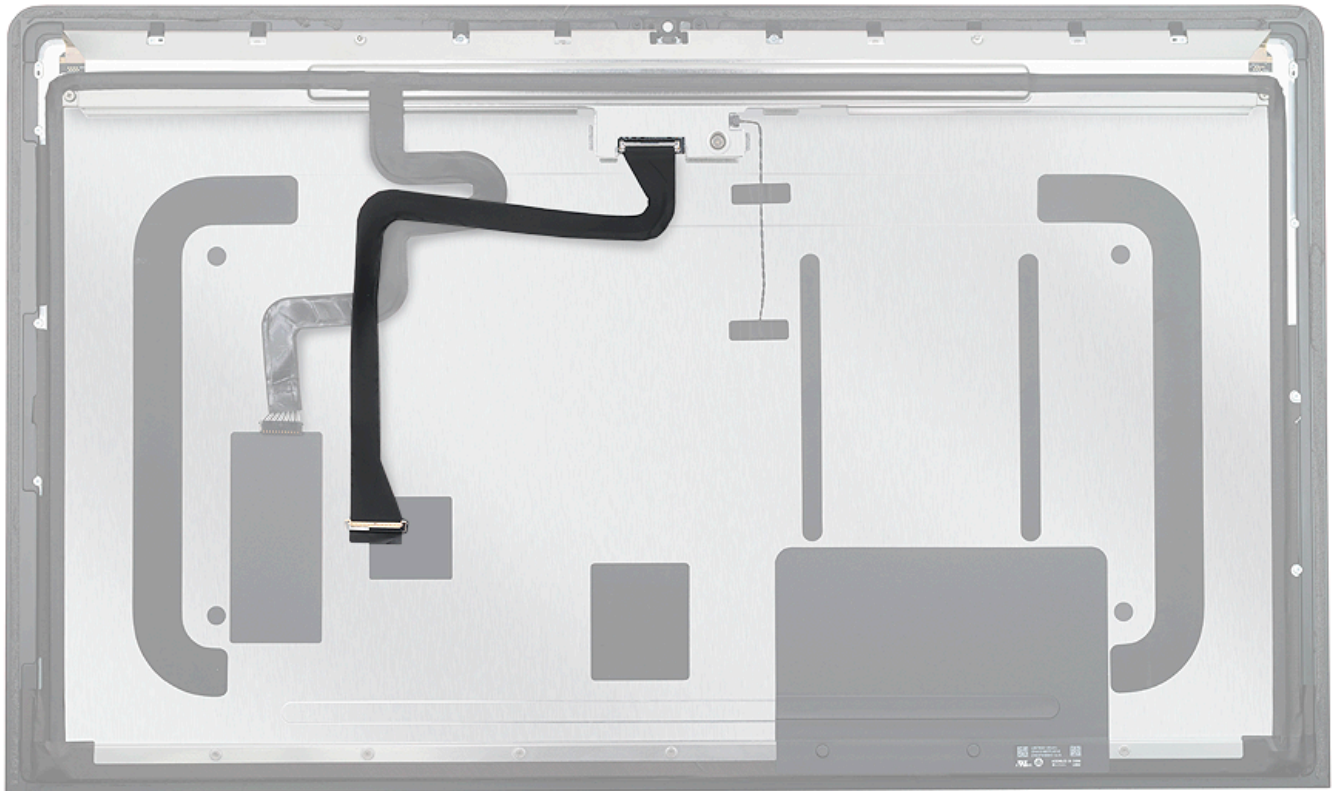
Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

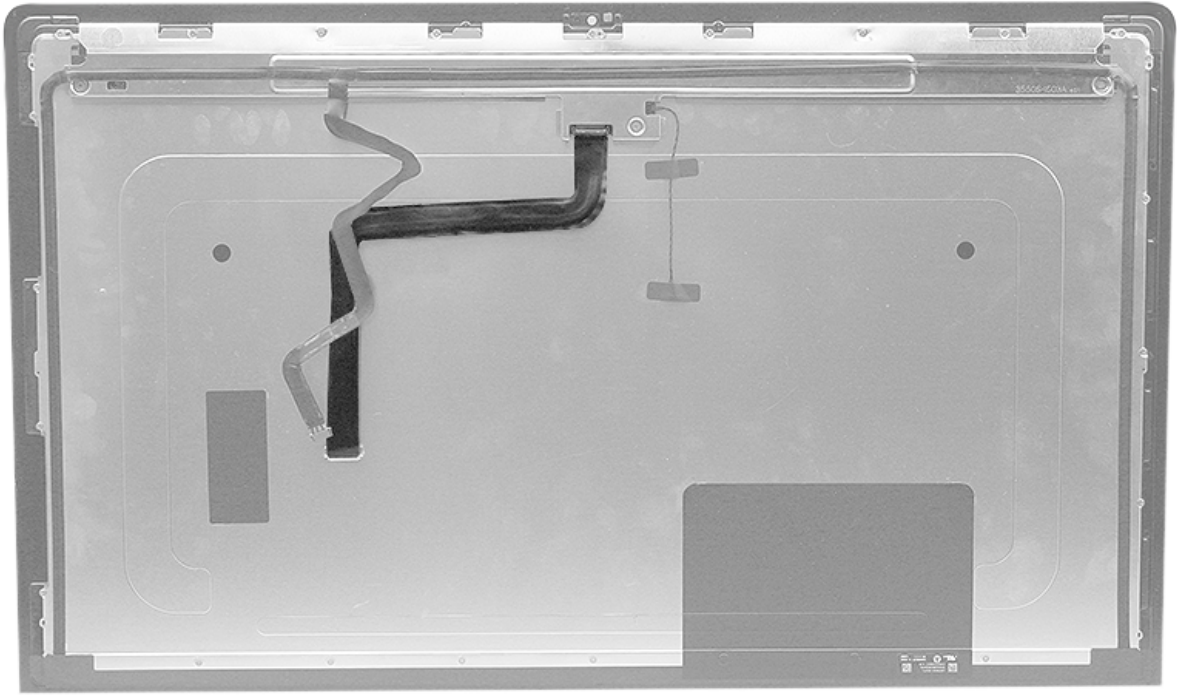
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

**iMac (Retina 5K, 27-inch, Late 2014)**

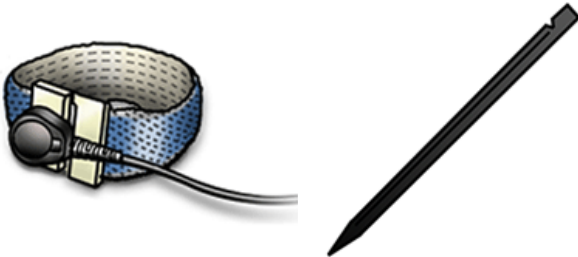


**iMac (27-inch, Late 2012 and Late 2013)**



## Tools

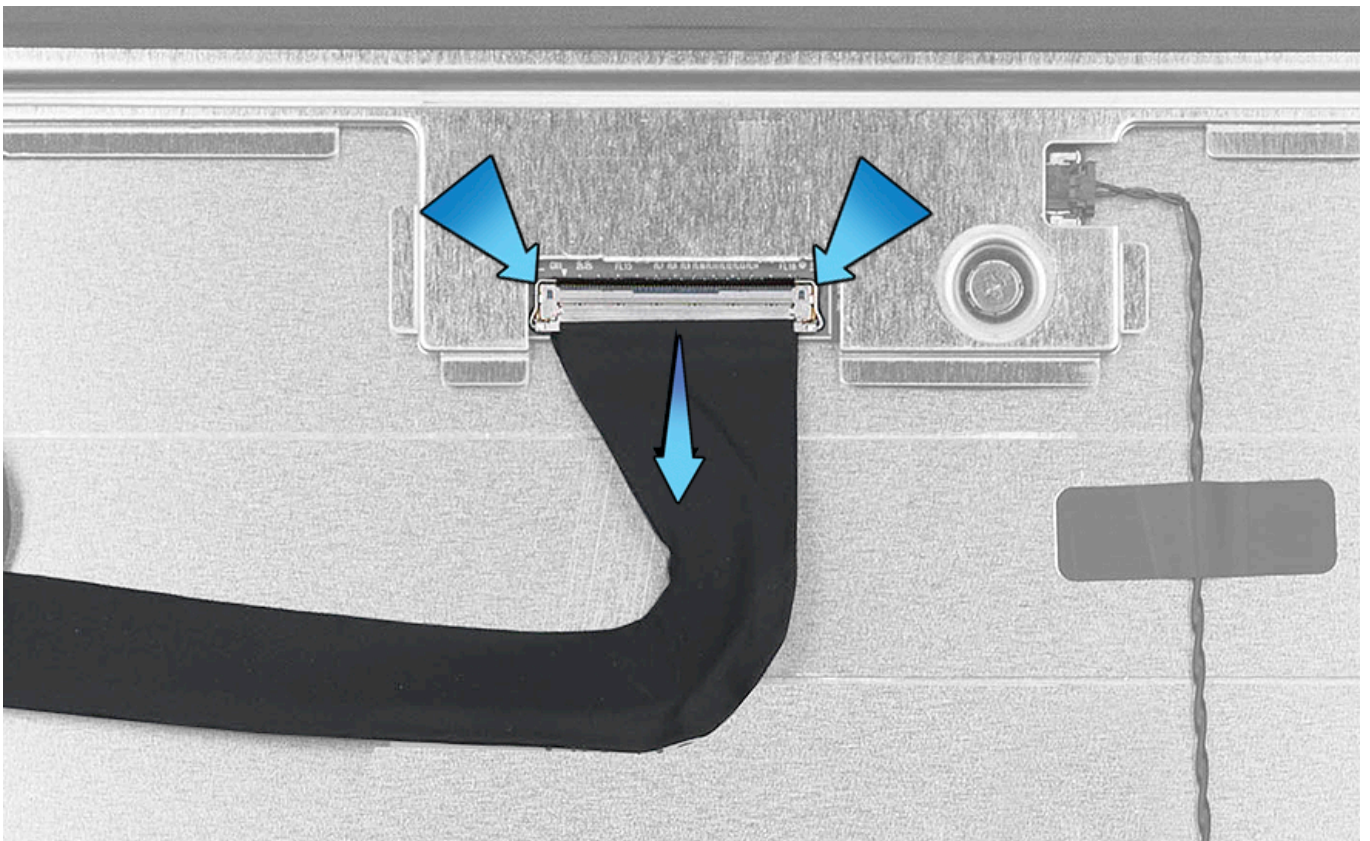
- ESD wrist strap and mat
- Black stick



## Steps For Removal

1. Remove any tape that secures the Embedded DisplayPort (eDP) cable to the display panel.
2. Use a black stick to "unlock" the lock bar by gently flipping the bar toward the eDP cable.
3. Gently pull the eDP cable out of the connector.





### Steps For Reassembly

1. Insert the eDP cable into its connector. Flip the lock bar up, ensuring that the cable is securely connected. Replace any tape that was covering the cable.  
**Important:** Press down around the lock bar to lock the lever into place.
2. [Replace the display panel VHB strips.](#)
3. [Replace the display panel.](#)

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Display Thermal Sensor Cable

## First Steps

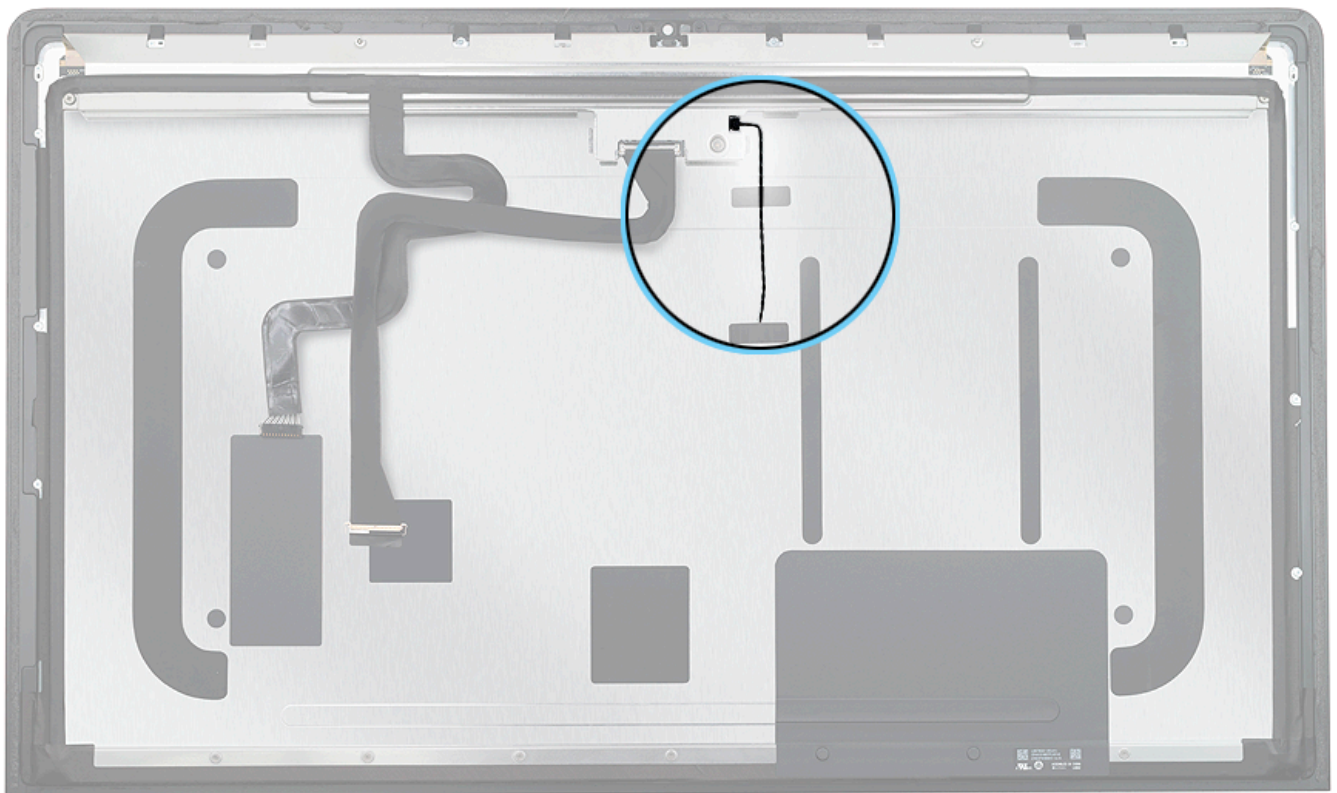
Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

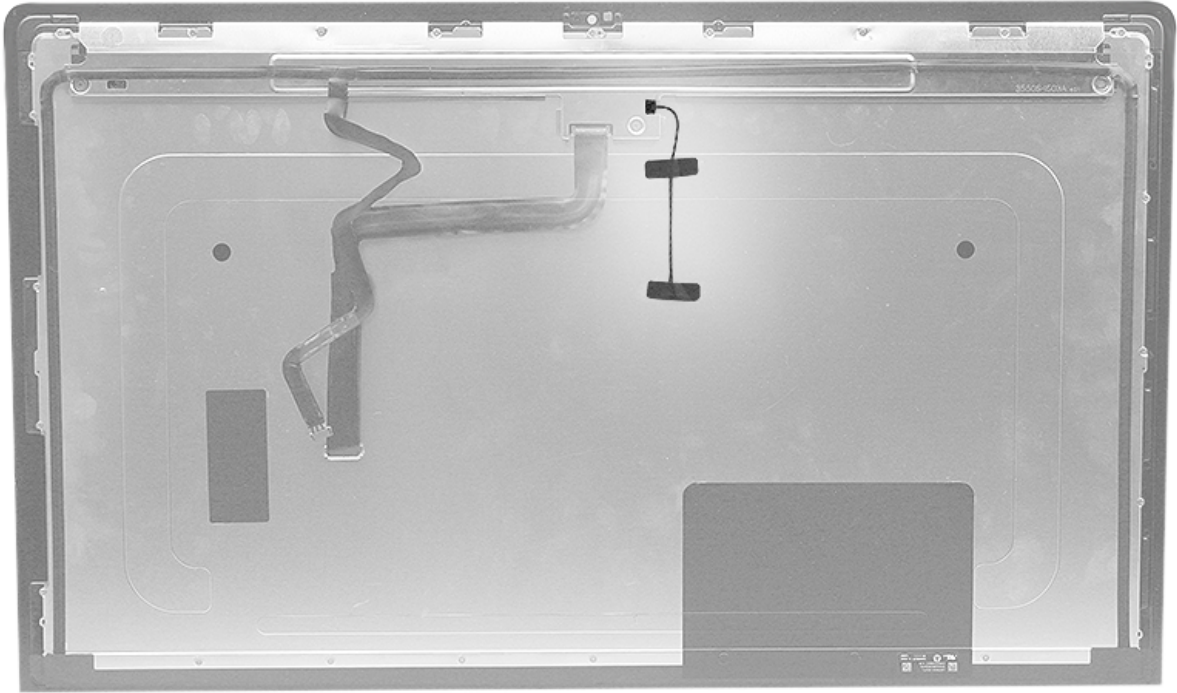
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)

**iMac (Retina 5K, 27-inch, Late 2014)**

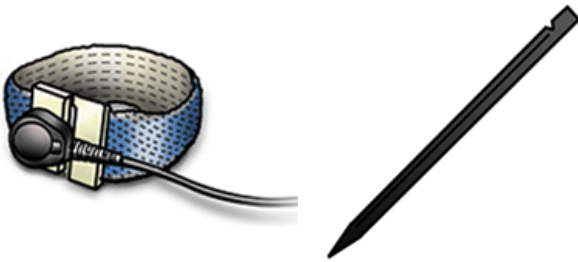


**iMac (27-inch, Late 2012 and Late 2013)**



## Tools

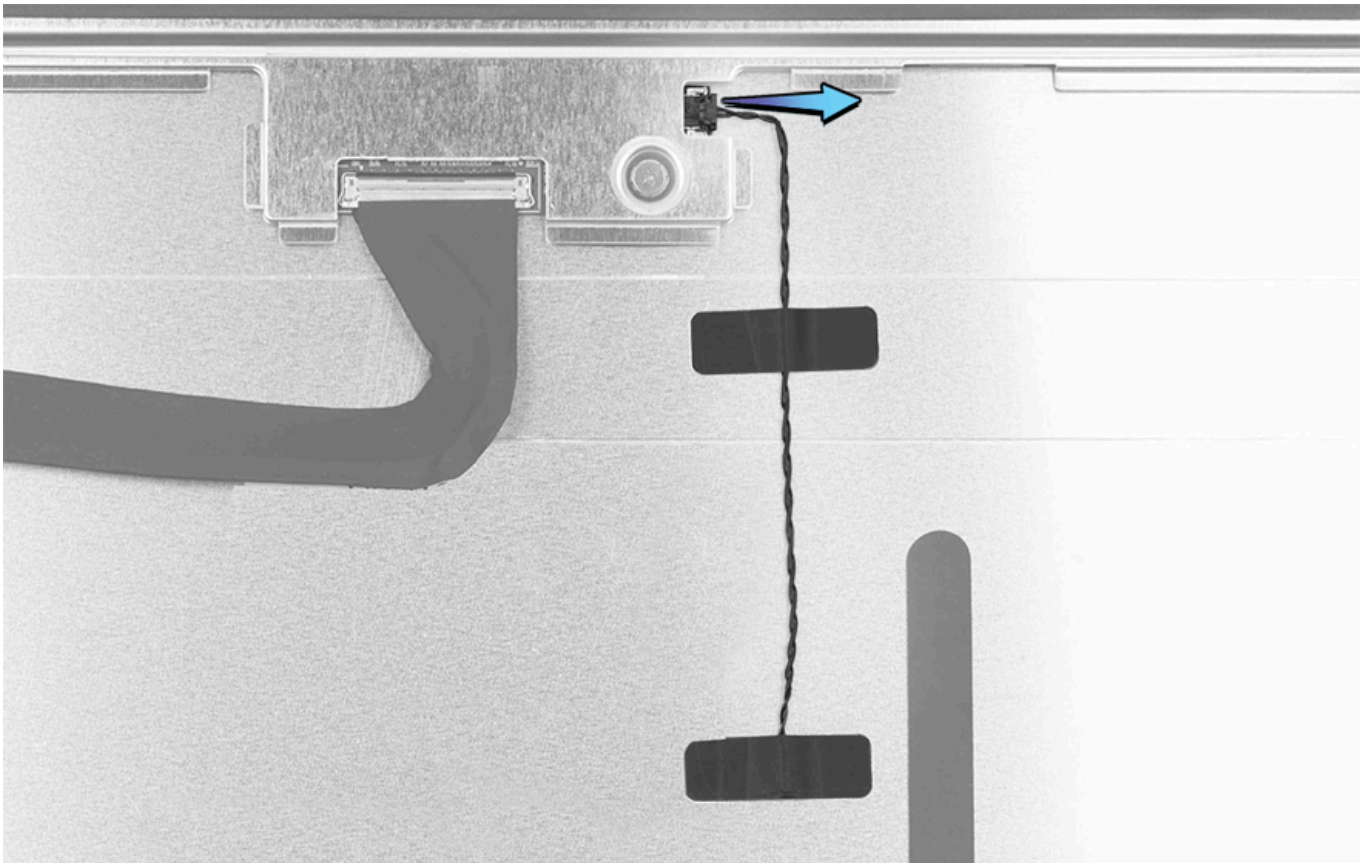
- ESD wrist strap and mat
- Black stick



## Steps For Removal

1. Remove any tape that secures the display thermal sensor cable to the display panel.
2. Use the pointed end of a black stick to gently push the display thermal sensor cable out of its connector.
3. Remove the two pieces of tape that secure the thermal sensor cable to the display panel. Use a black stick to pry the square sensor board (located under the lower piece of tape) off of the display panel.





### Steps For Reassembly

1. If you are installing a replacement thermal sensor cable, peel the backing off of the sensor board and stick the sensor to the back of the display panel. If you are reinstalling the original thermal sensor cable, press the sensor board onto the back of the display panel.
2. Insert the cable into its connector.
3. Secure the cable with tape.
4. [Replace the display panel VHB strips.](#)
5. [Replace the display panel.](#)

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Fan

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

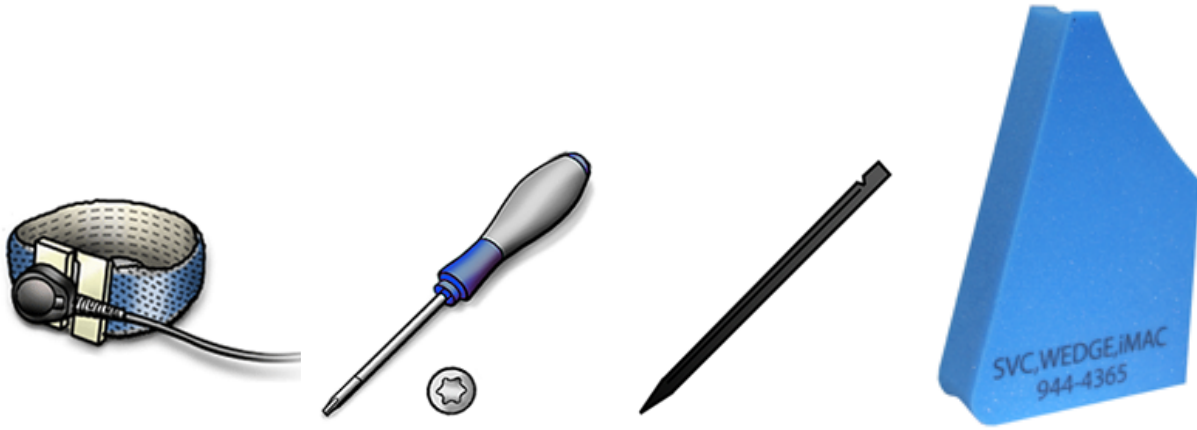
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



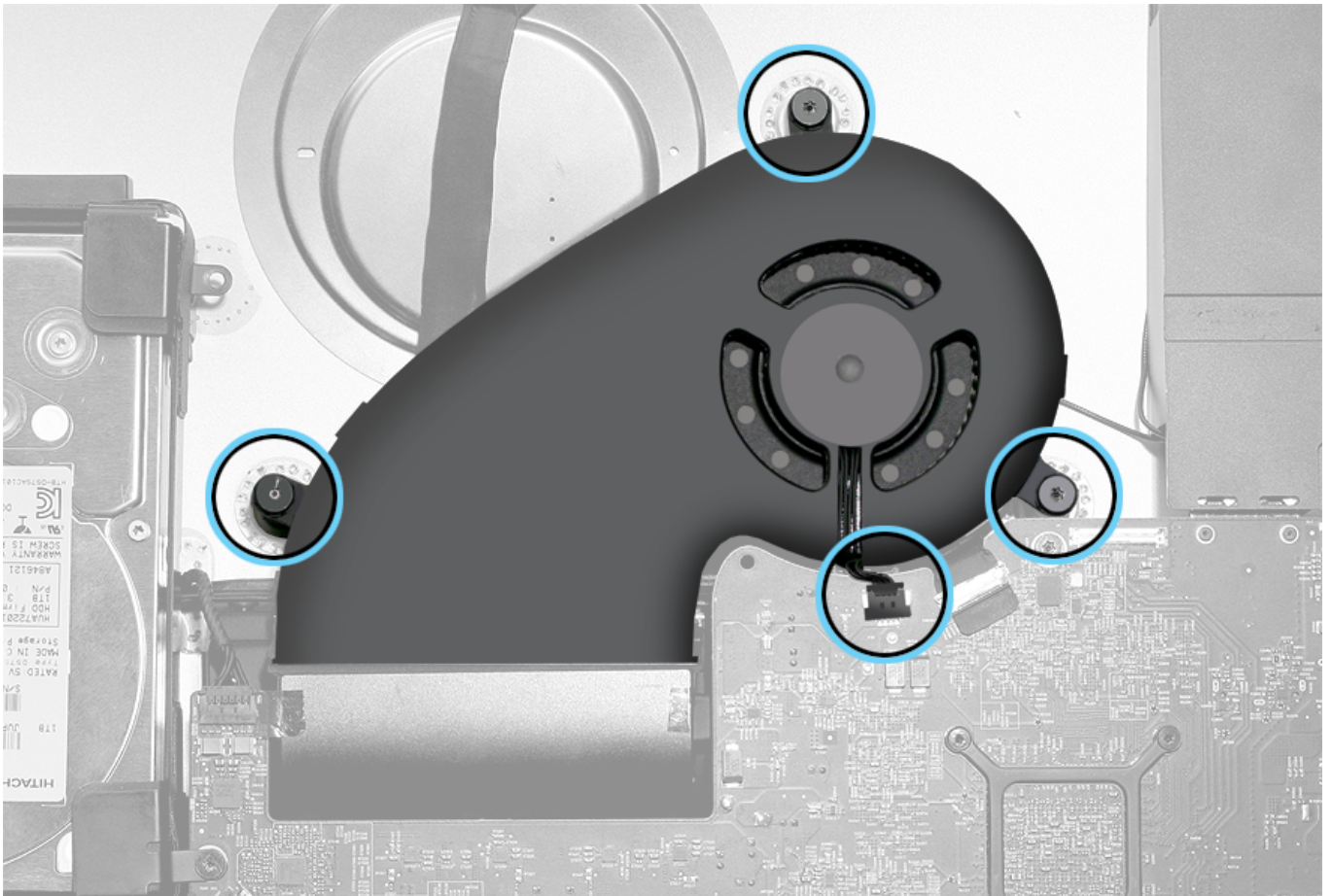
## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



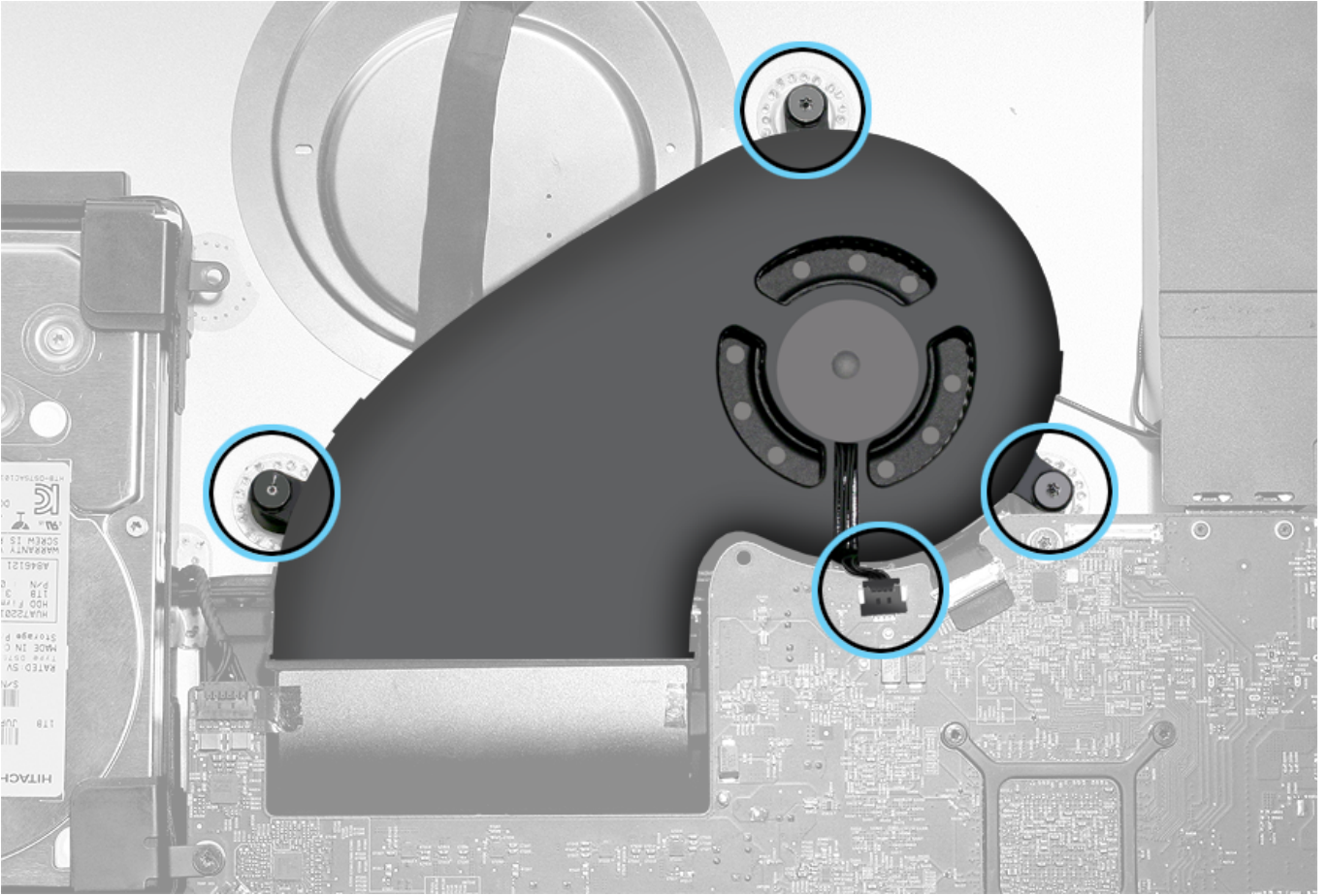
## Steps For Removal

1. Use a black stick to disconnect the fan cable from the logic board.
2. Remove three (3) 12.3 mm T10 screws (923-0332) from the fan.



## Steps For Reassembly

1. Check that the fan cable routes through the hooks on the side of the fan.
2. Connect the fan cable to the logic board.
3. Install three (3) 12.3 mm T10 screws (923-0332) to the fan.





# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Camera

## First Steps

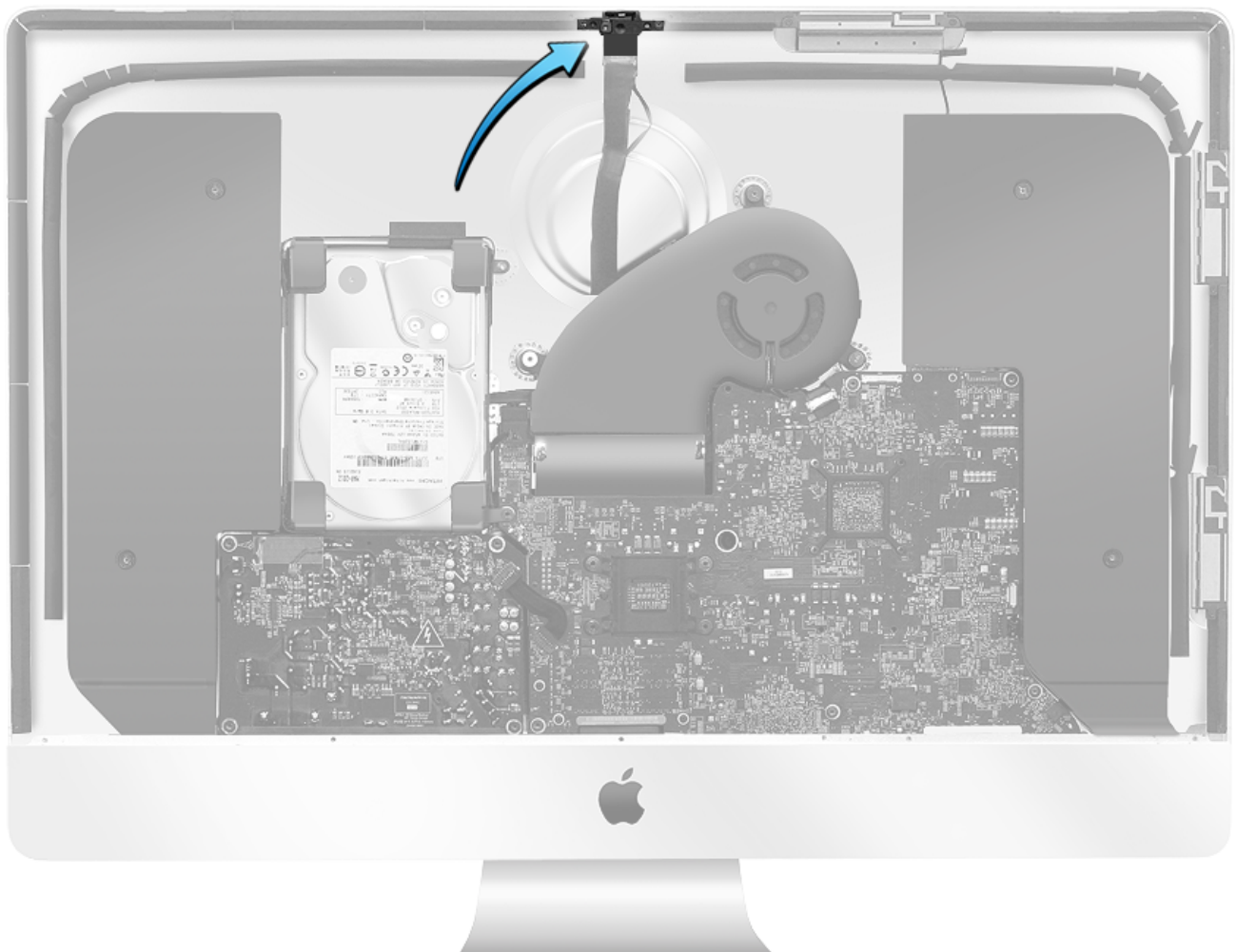
Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV242: Camera Replacement Video](#).

Before you begin:

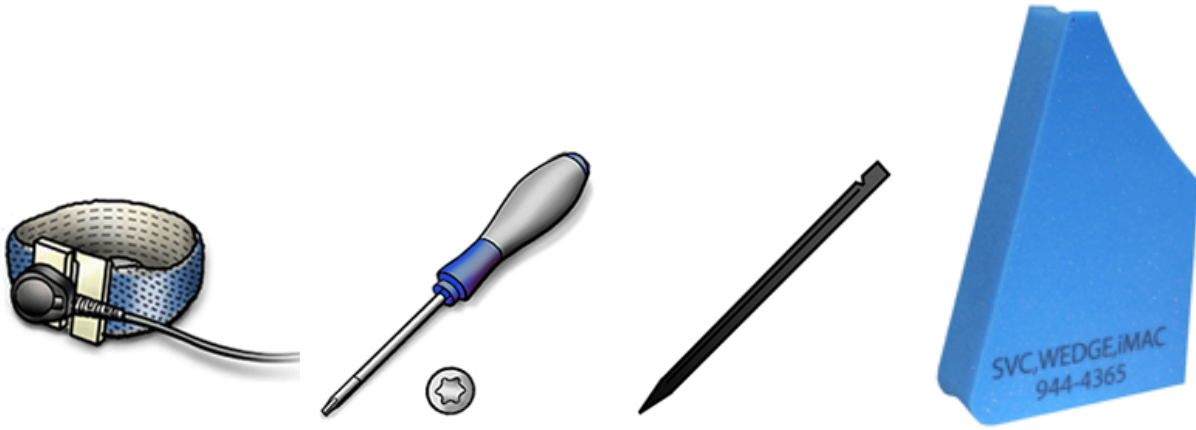
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



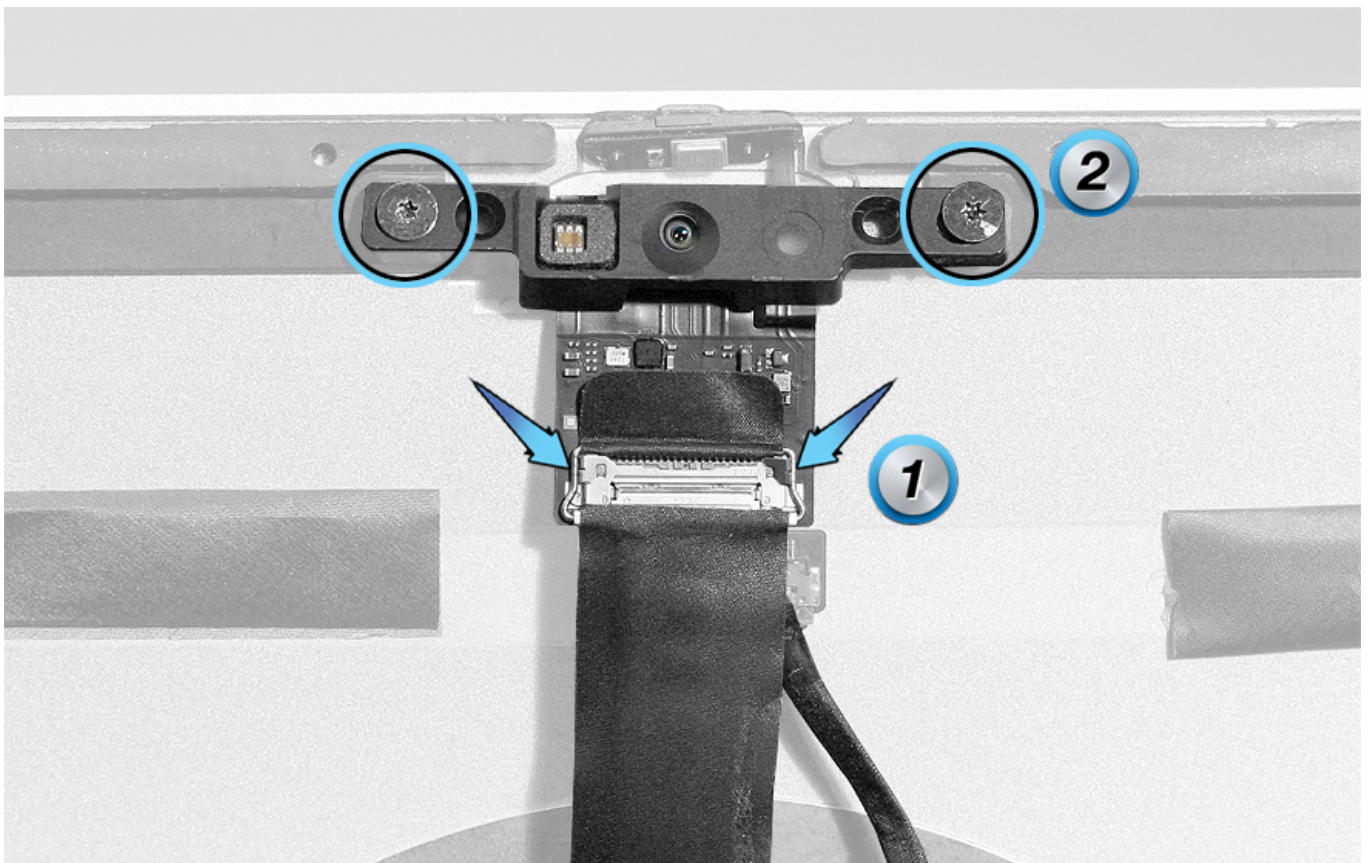
## Tools

- ESD wrist strap and mat
- Torx T5 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



## Steps For Removal

1. Use a black stick to unlock the lock bar (#1) by gently flipping the bar over toward the cable. Gently pull the cable — not the lock bar — to disconnect the cable.
2. Remove two (2) 3.96 mm T5 screws (923-0339) (#2) from the camera.



## Steps For Reassembly

1. Install two (2) 3.96 mm T5 screws (923-0339) on the camera. **Note:** If installing a replacement camera, do not forget to remove the protective film covering the lens.
2. Carefully insert the camera cable into the connector. Check that the cable is firmly inserted into the connector.
3. Flip the lock bar up to the closed position. **Important:** Press around the edges of the lock bar to secure the camera cable.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Camera/Microphone Cable

## First Steps

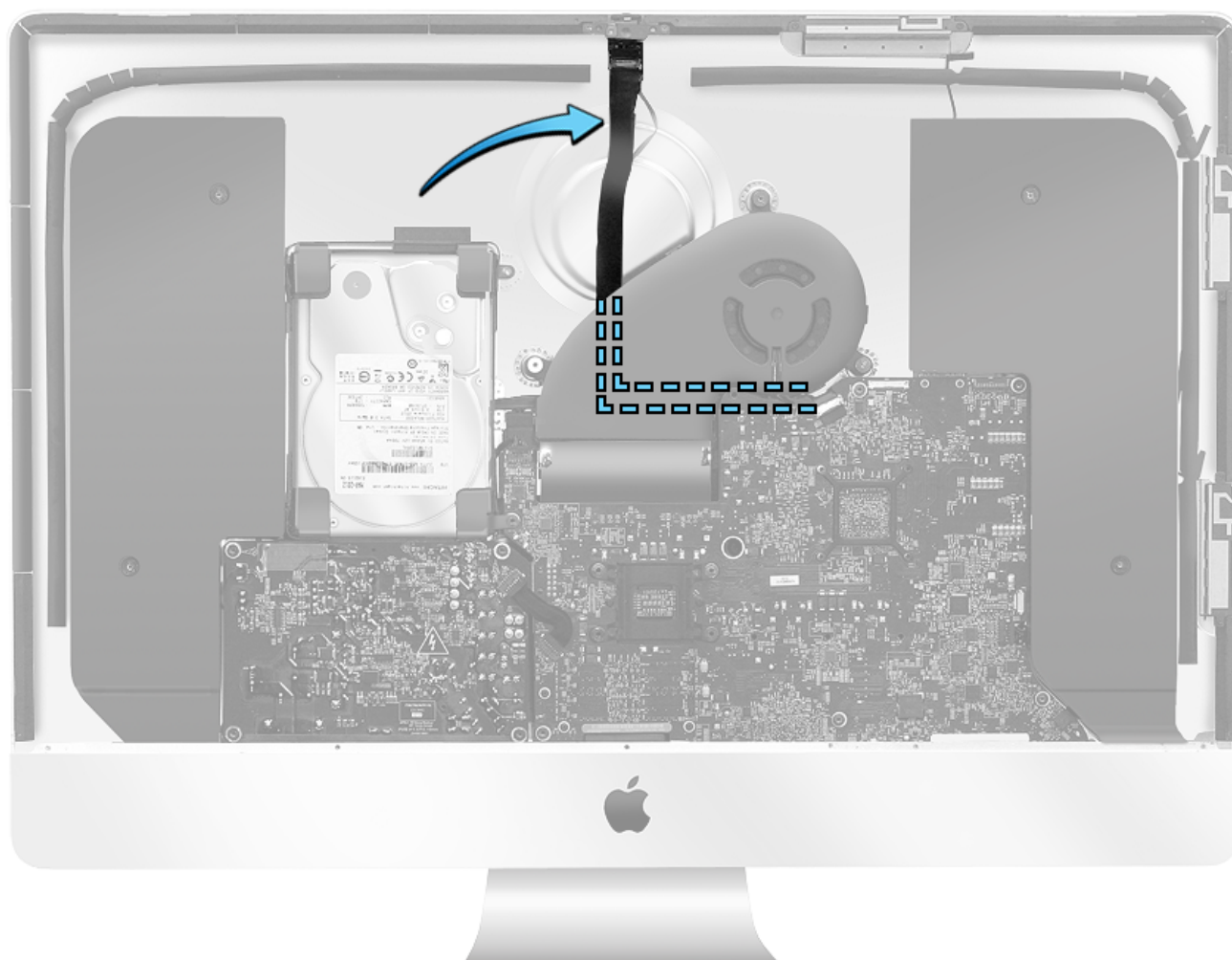
Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV243: Camera/Microphone Cable Replacement Video](#).

Before you begin:

Remove

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)



## Tools

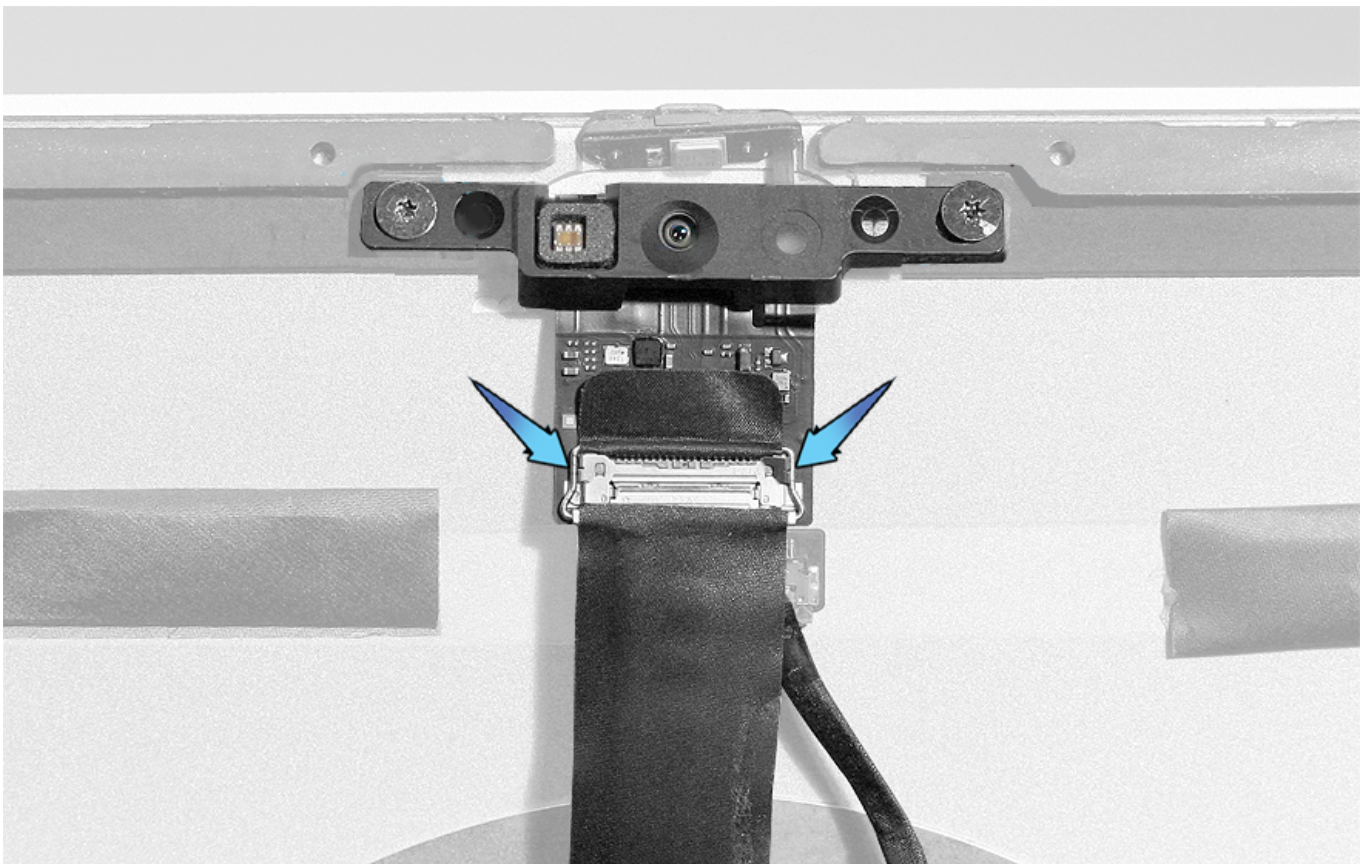
- ESD wrist strap and mat
- Black stick
- Service wedge (iMac)



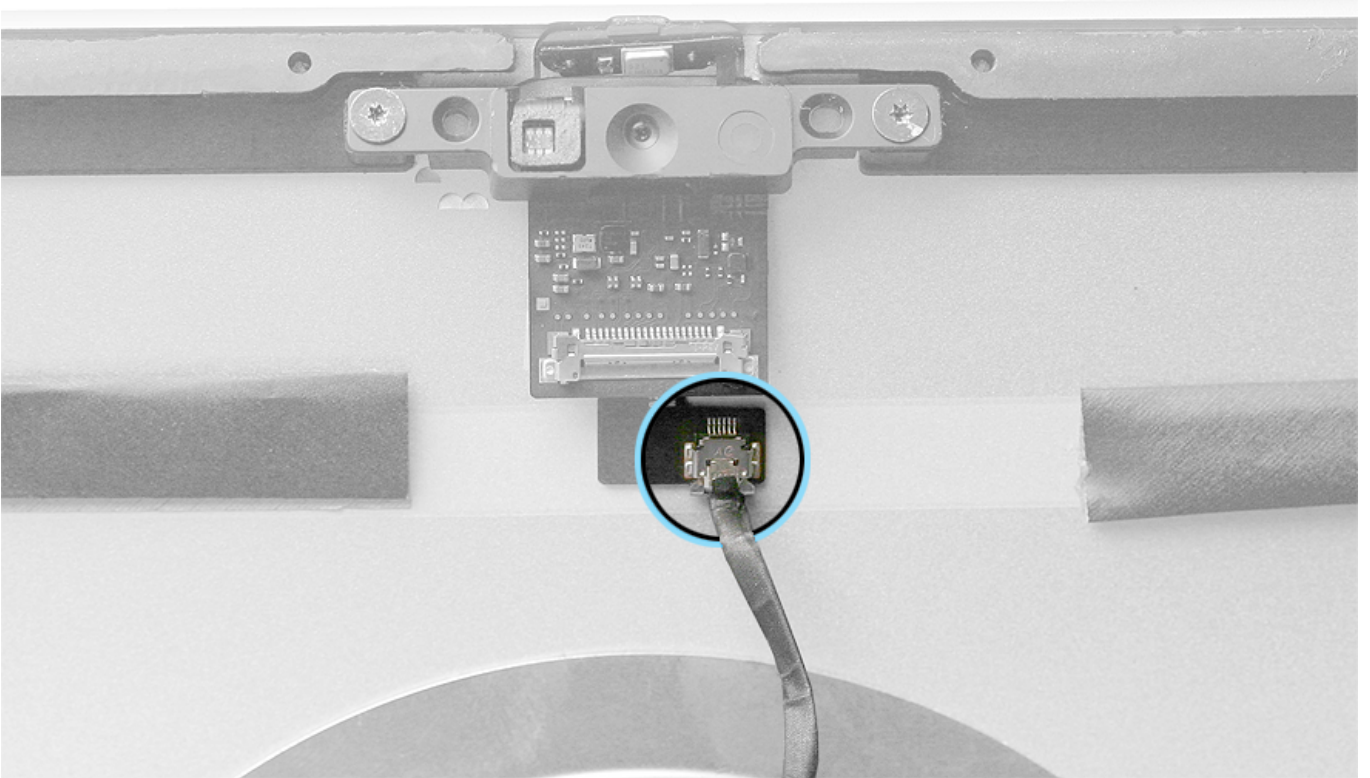


## Steps For Removal

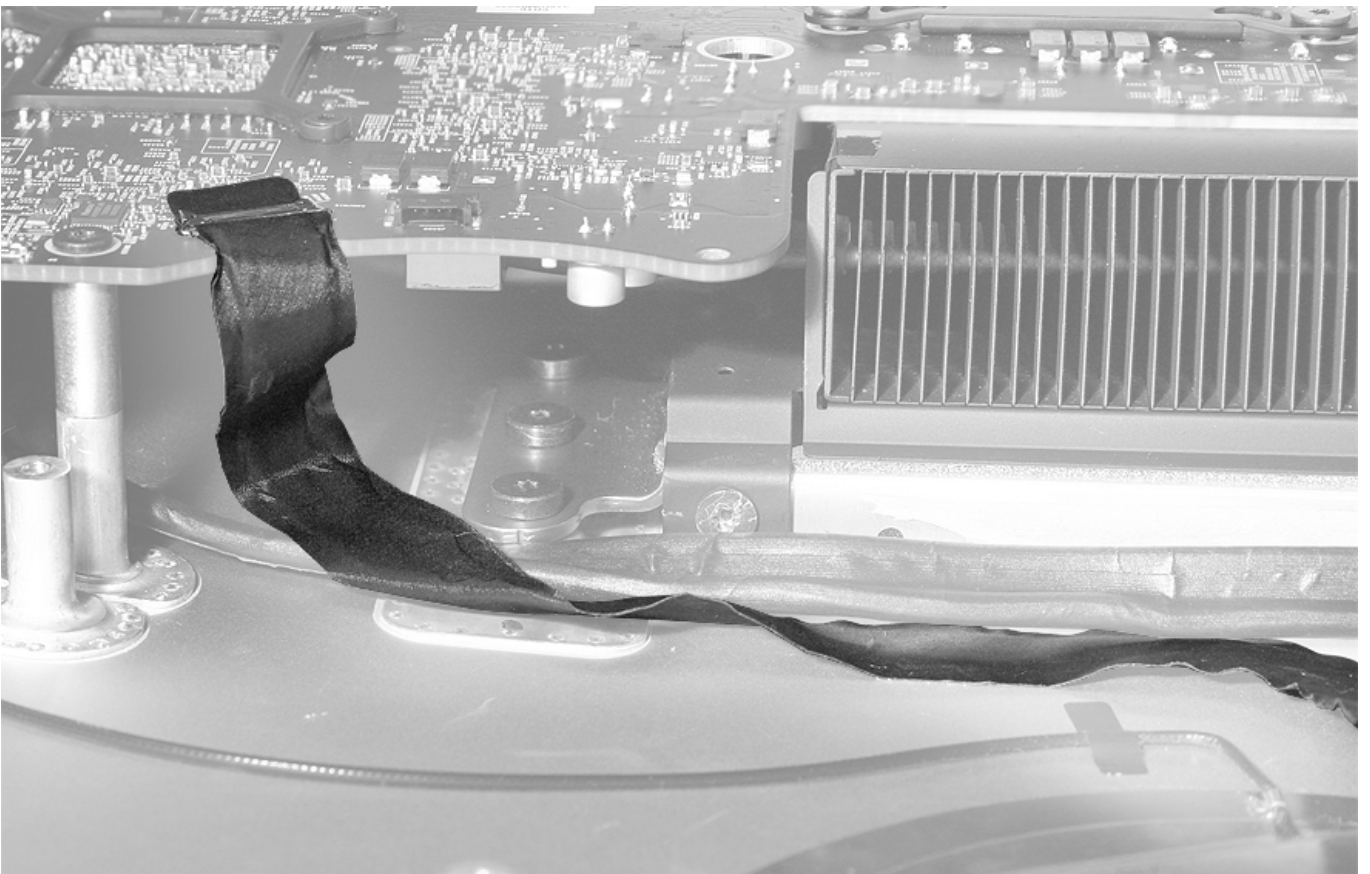
1. Use a black stick to “unlock” the lock bar by gently flipping the bar over toward the cable. Gently pull the cable — not the lock bar — to disconnect the cable.



2. Pull the microphone cable straight out of the connector.



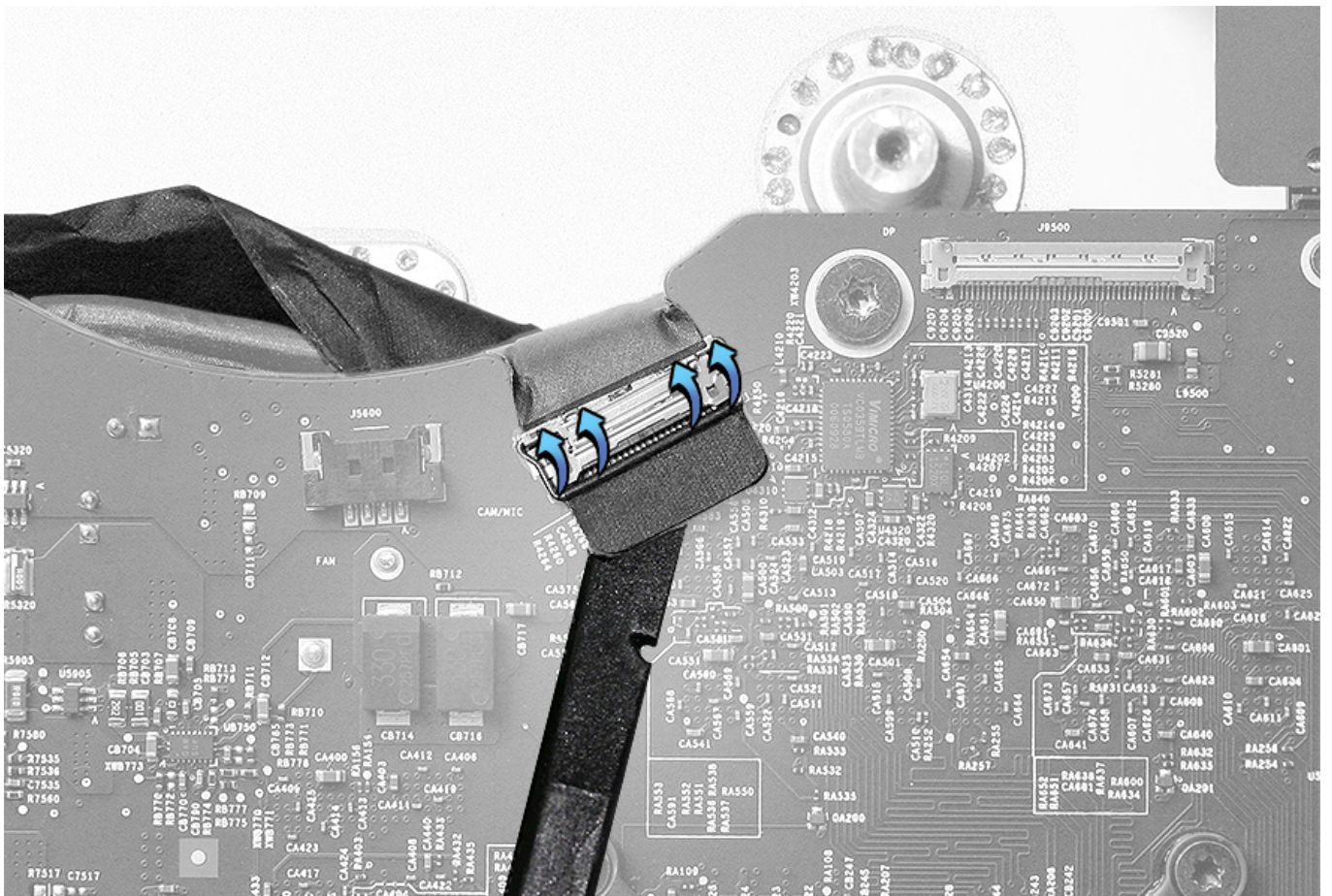
3. Before removing the cable, note the cable routing.



4. Use a black stick to “unlock” the camera cable lock bar by flipping the locking-lever bar back. Gently pull the cable — not the lock bar — to disconnect the cable.

5. Remove the cable from the rear housing.





## Steps For Reassembly

1. Position the camera/microphone cable in the rear housing.
2. Connect the microphone cable to connector on the microphone board.
3. Connect the camera cable to the camera board. Flip the locking-lever bar up and check that it is secure.
4. Press along the cable to adhere it to the rear housing.
5. Insert the camera cable into the logic board connector and flip the locking-lever bar toward the logic board. Press down around the locking-lever bar to securely lock the cable connector in place.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Chin Strap

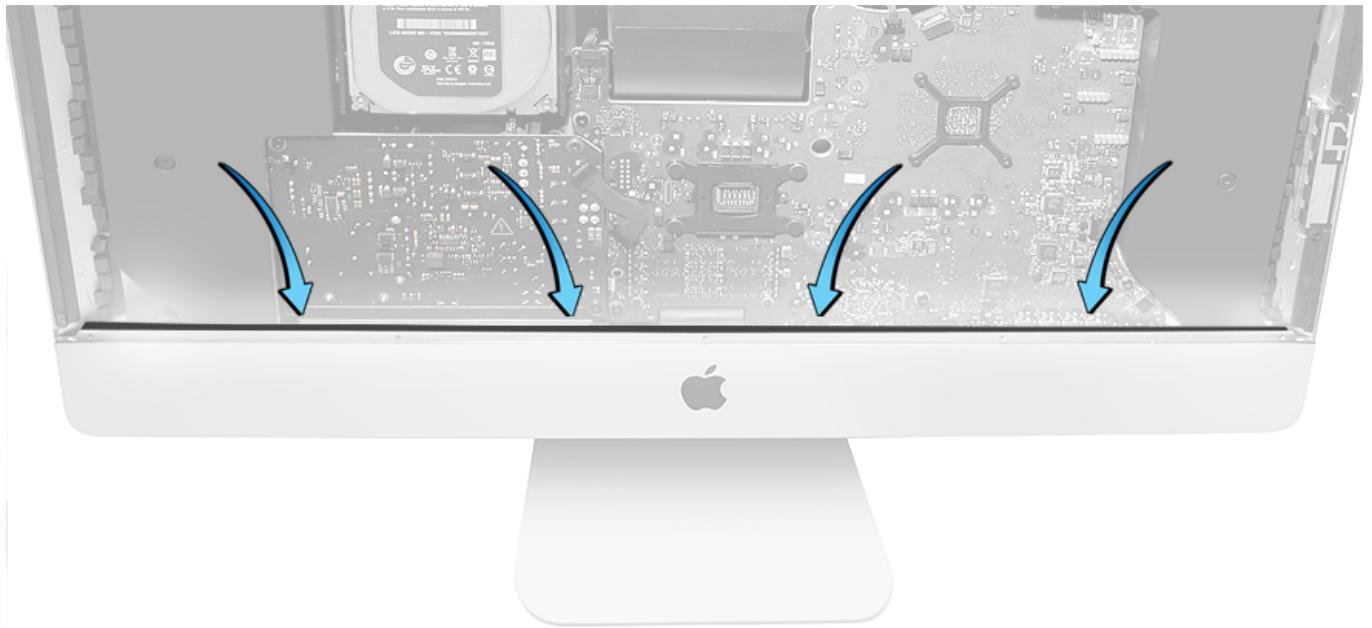
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

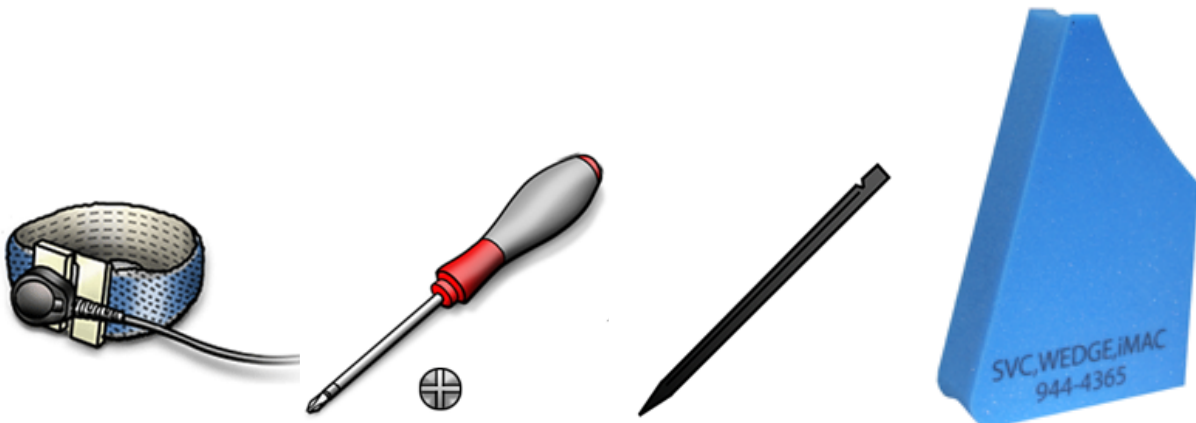
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)



## Tools

- ESD wrist strap and mat
- Phillips #00 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



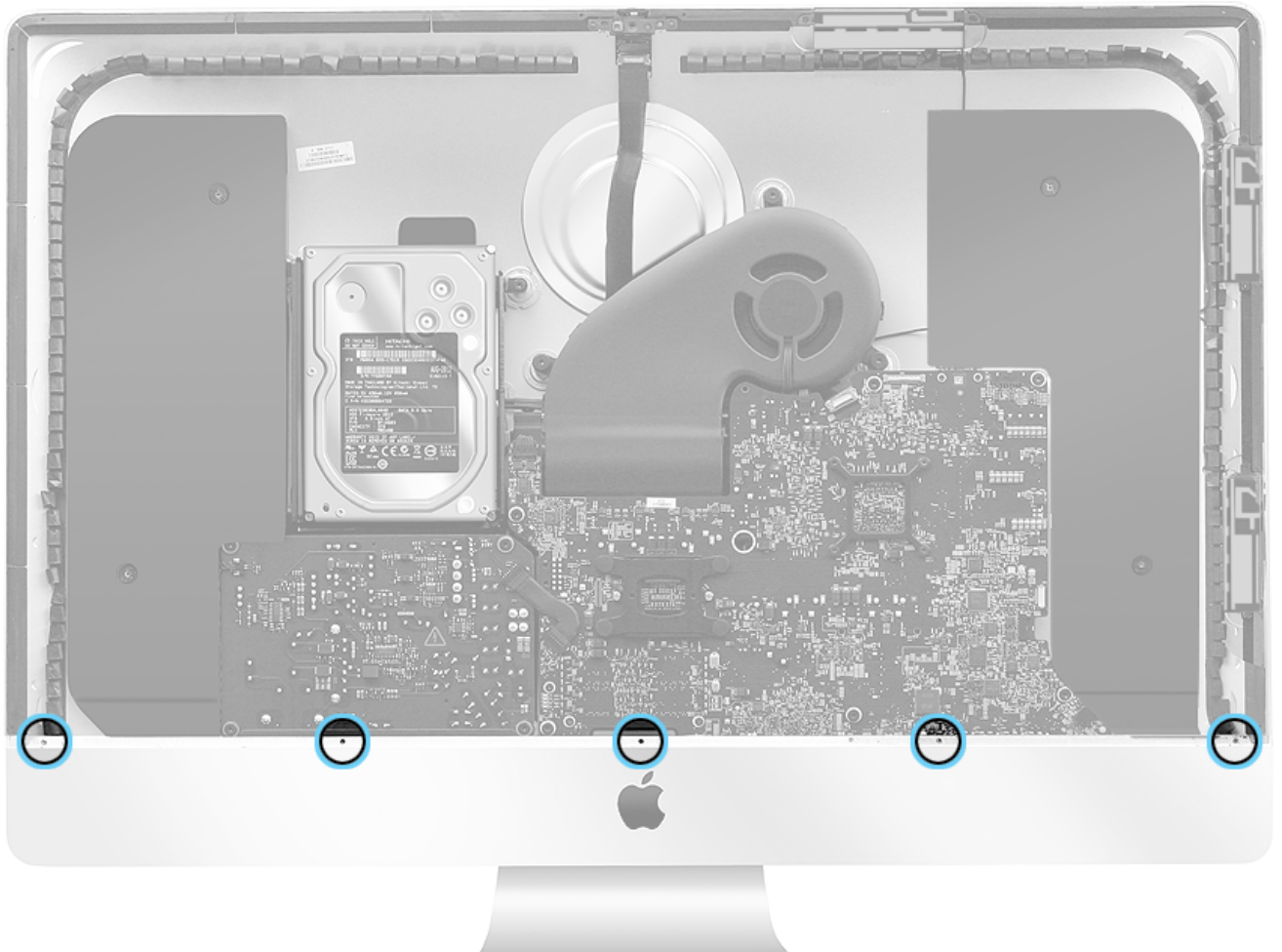
## Steps For Removal

1. Remove screws:

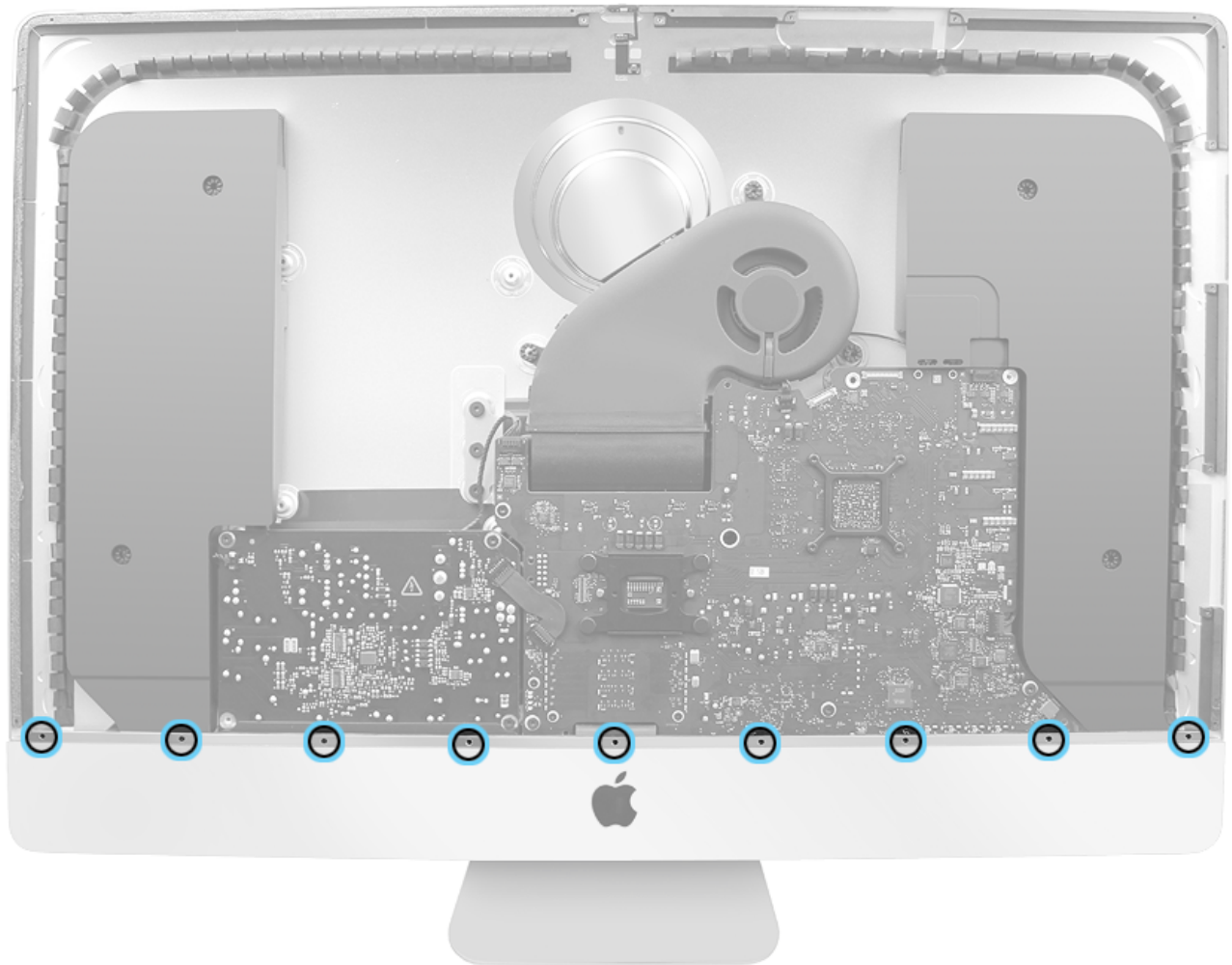
- Late 2012:
  - Five (5) 3 mm Phillips #00 screws (923-0338)
- Late 2013 and Retina 5K:
  - Nine (9) 3 mm Phillips #00 screws (923-0338)



**iMac (27-inch, Late 2012)**



**iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014)**



2. Set the chin strap aside. **Note:** Be careful not to bend the chin strap.

#### iMac (27-inch, Late 2012) - 5-hole chin strap



#### iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014) - 9-hole chin strap



### Steps For Reassembly

**IMPORTANT:** Before ordering a replacement chin strap, check whether the system has a 5-hole chin strap or 9-hole chin strap. If the system has a 5-hole chin strap, order the iMac (27-inch, Late 2012) chin strap kit. If the system has a 9-hole chin strap, order the iMac (27-inch, Late 2013) / iMac (Retina 5K, 27-inch, Late 2014) chin strap kit.

1. Insert the chin strap into the rear housing. Be sure the metal screw holes face the inside edge of the chin on the rear housing. The foam edge on the chin strap should be facing up.



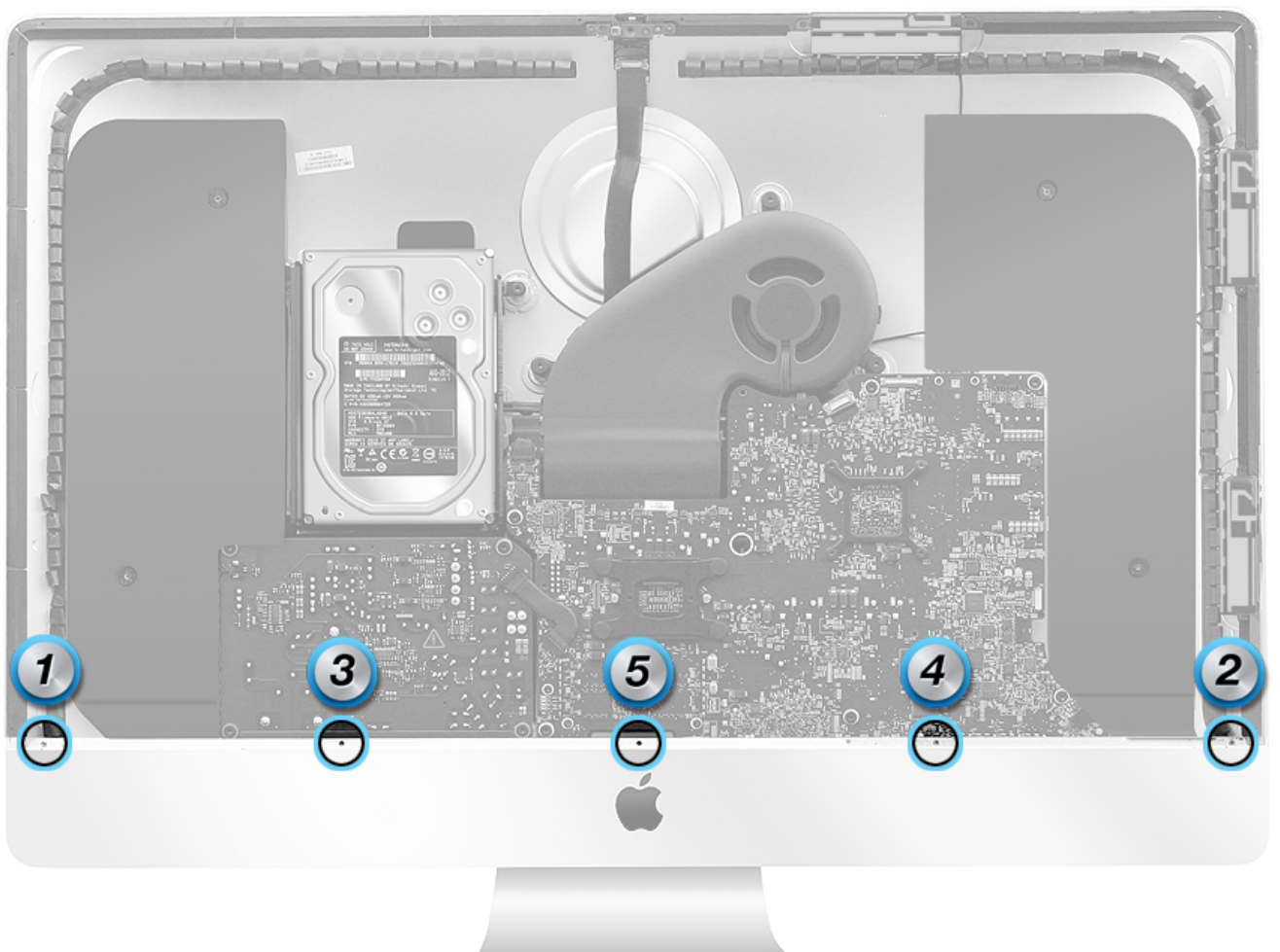
2. Use a black stick to press the chin strap against the front frame, if needed. Refer to the next step for screw replacement order.





3. Install five (5) 3 mm Phillips #00 screws (923-0338) in the following order:

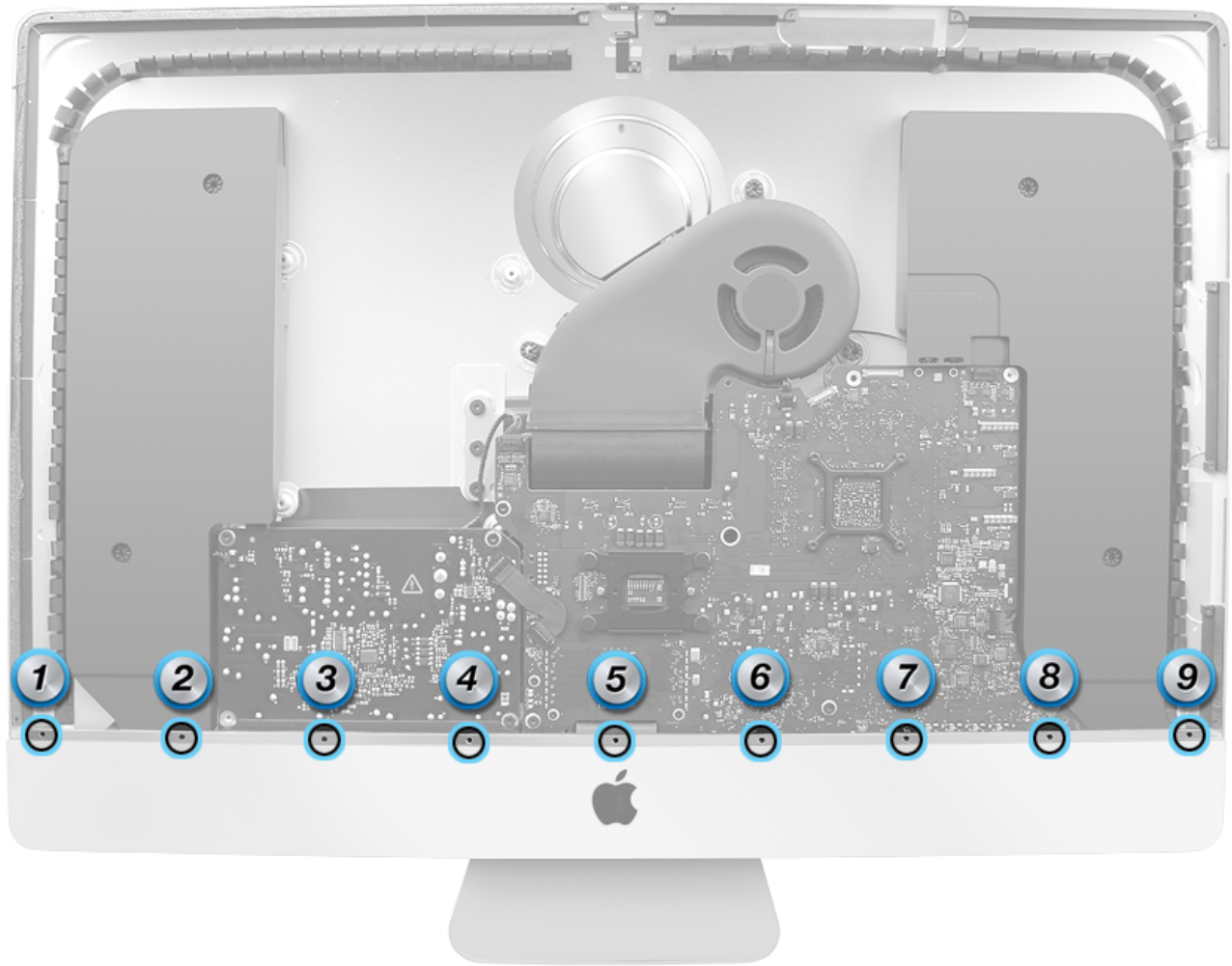
**iMac (27-inch, Late 2012): 5-hole chin strap**





4. Install nine (9) 3 mm Phillips #00 screws (923-0338) in the following order:

**iMac (27-inch, Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): 9-hole chin strap**



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Right Speaker

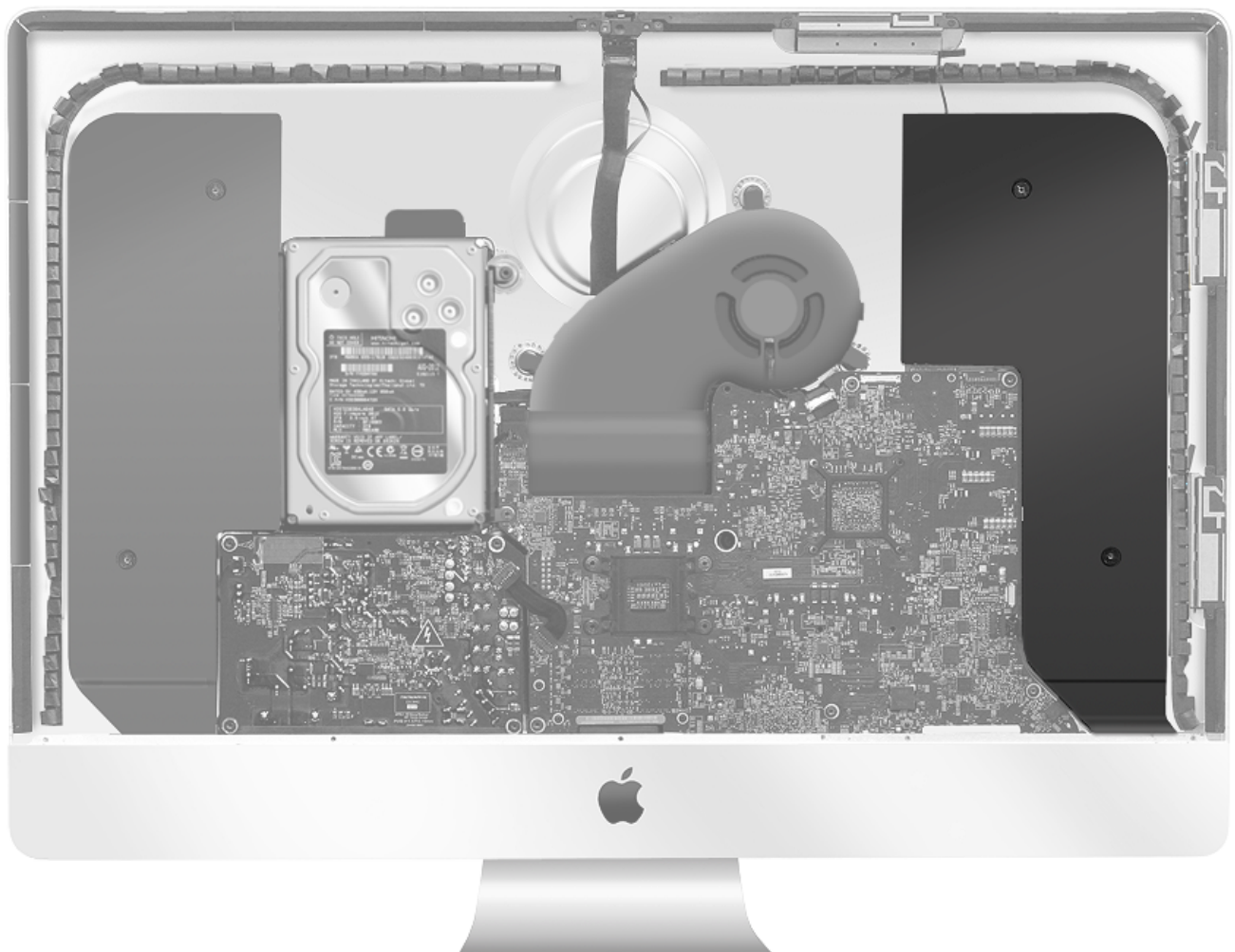
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

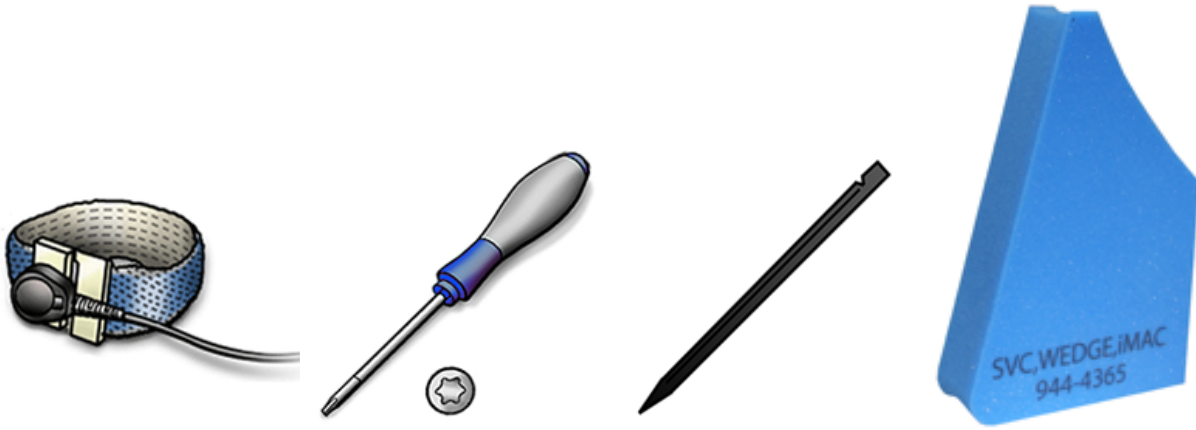
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)



## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



## Steps For Removal

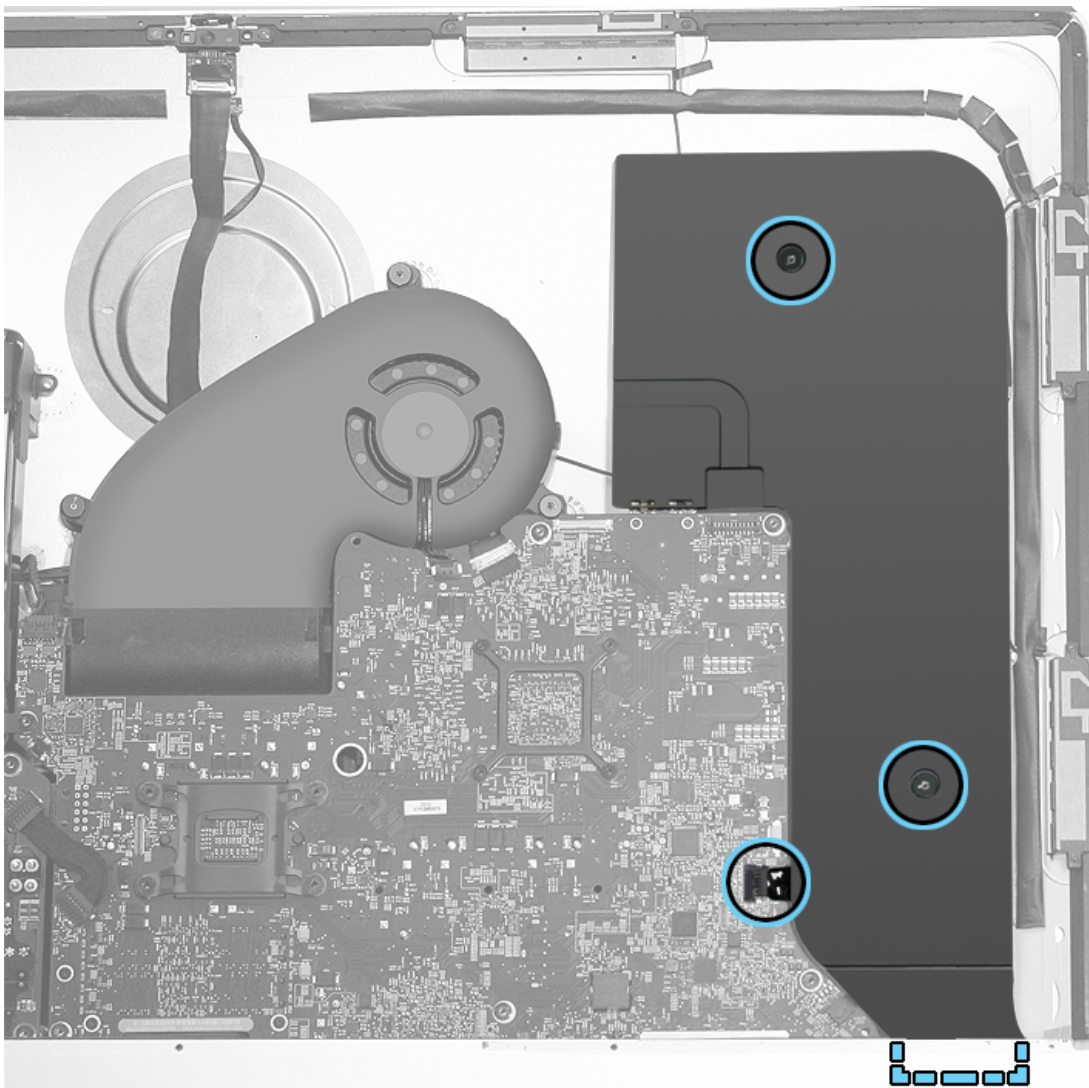


**Note:** The speakers must be replaced in pairs. For left speaker removal instructions, refer to [iMac \(27-inch, Late 2012 and Late 2013\)](#) and [iMac \(Retina 5K, 27-inch, Late 2014\): Left Speaker](#).

1. Completely unscrew two (2) T10 screws and disconnect the speaker cable from logic board. **Note:** The screws tighten into rubber grommets and may remain in the screw holes when the speaker is removed. **Note:** The iMac (27-inch, Late 2013) model is shown for this procedure.

- 923-0333 (10 mm)





2. Pull speaker forward slightly (#1), then slide the speaker up (#2) and out of the rear housing.



### Steps For Reassembly

1. Carefully insert the speaker all the way into the rear housing.

**Note:** Push firmly to ensure that the speaker sits down inside the rear housing as far as possible. If the speaker is not positioned correctly in the rear housing, it can cause display interference issues.

2. Connect the speaker cable to the logic board and tuck the speaker cable under the logic board.
3. Install two (2) speaker screws.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Left Speaker

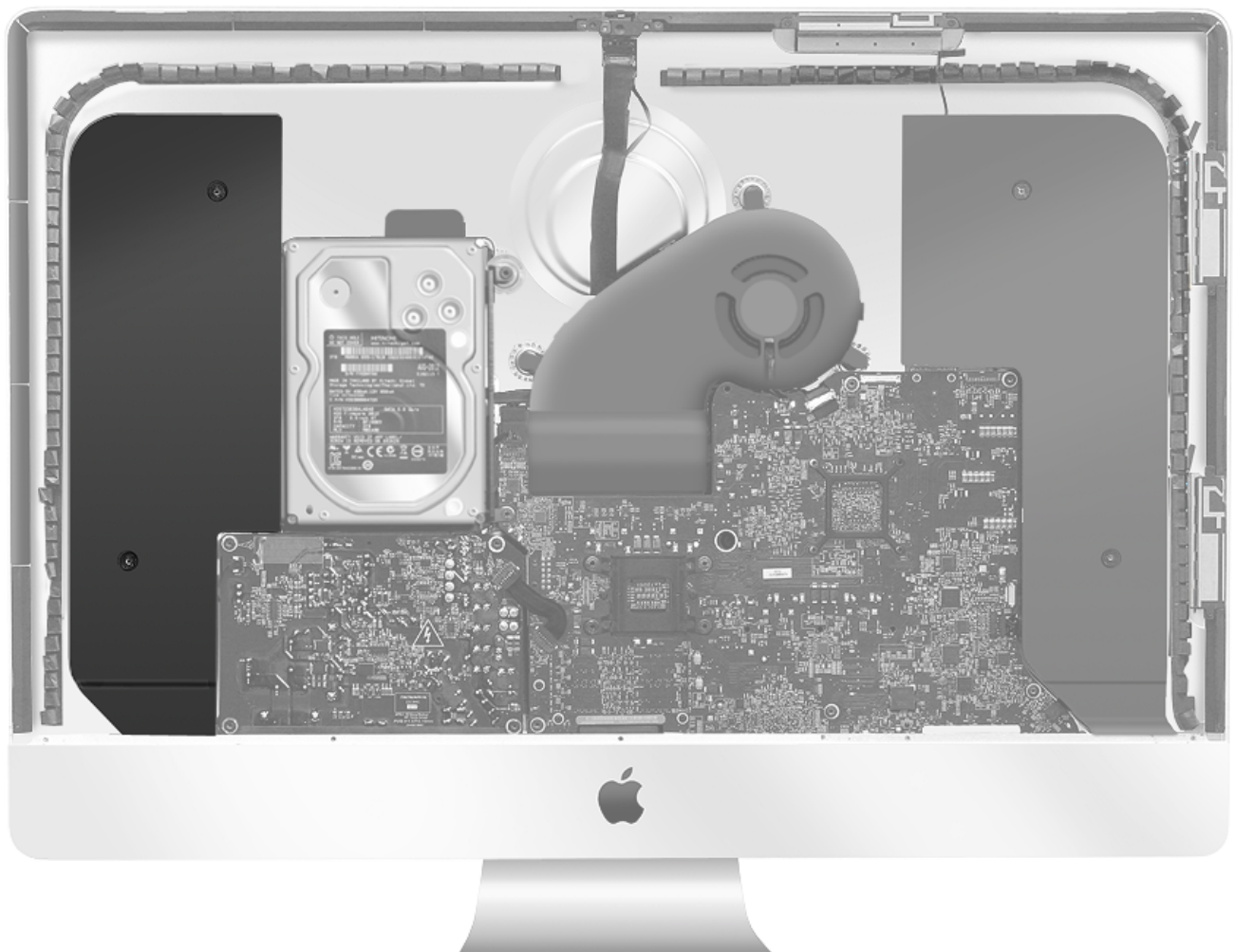
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

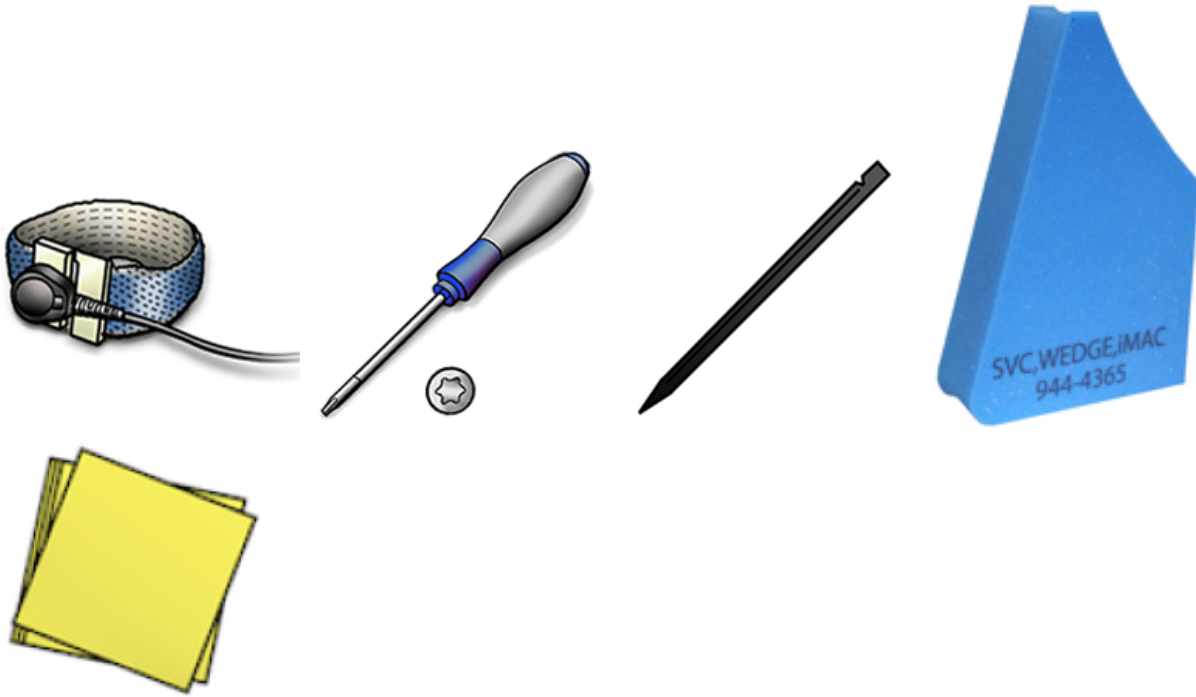
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)



## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)
- Sticky notes



## Steps For Removal

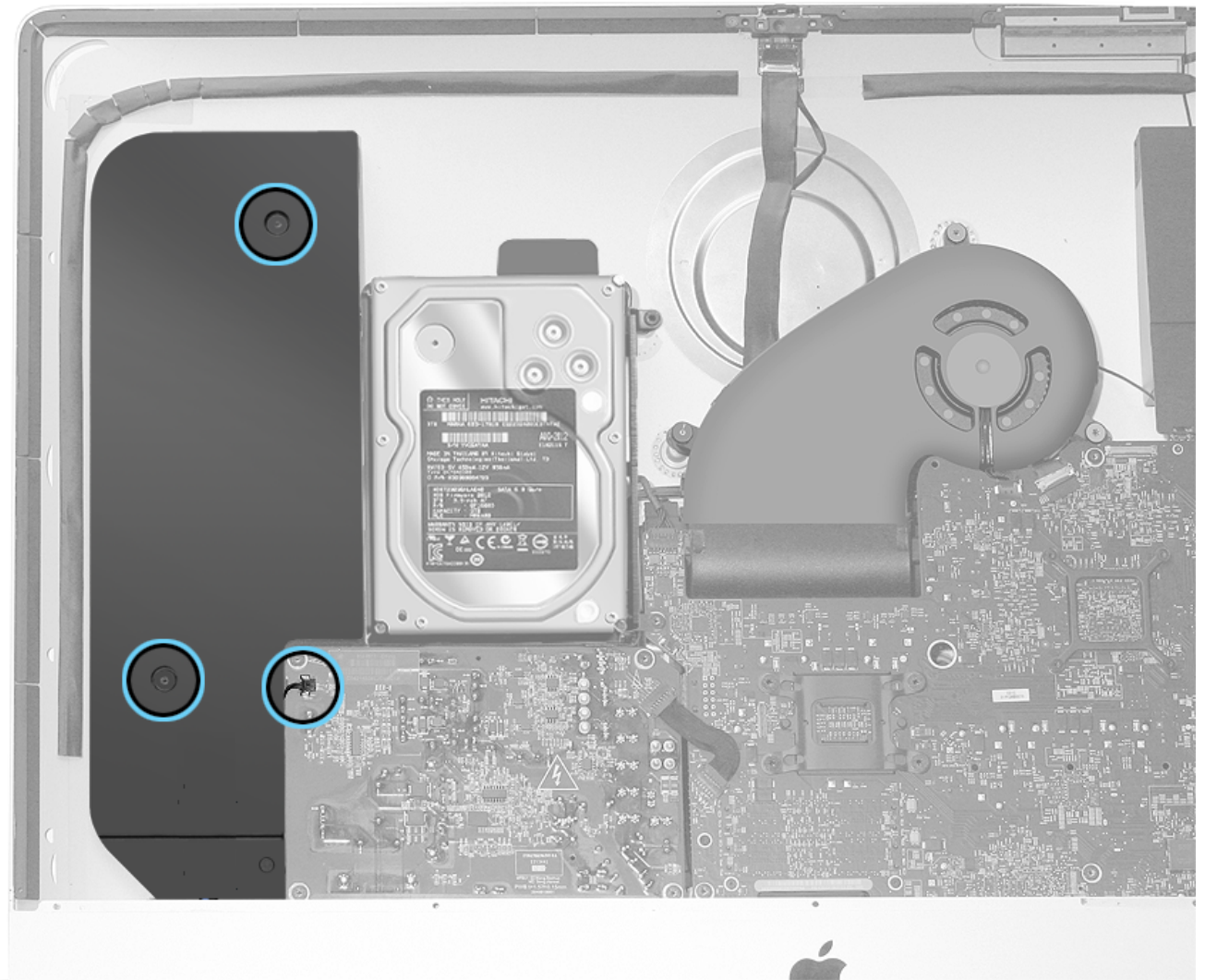


**Note:** The speakers must be replaced in pairs. To remove the right speaker, refer to [iMac \(27-inch, Late 2012 and Late 2013 and iMac \(Retina 5K, 27-inch, Late 2014\): Right Speaker](#).

1. Carefully disconnect the power button cable from the power supply. **Important:** If the power button cable breaks, the rear housing will require replacement. The power button cable is part of the rear housing.
2. Completely unscrew two (2) T10 screws. **Note:** The screws tighten into rubber grommets and may remain in the screw holes when the speaker is removed.
  - 923-0333 (10 mm)



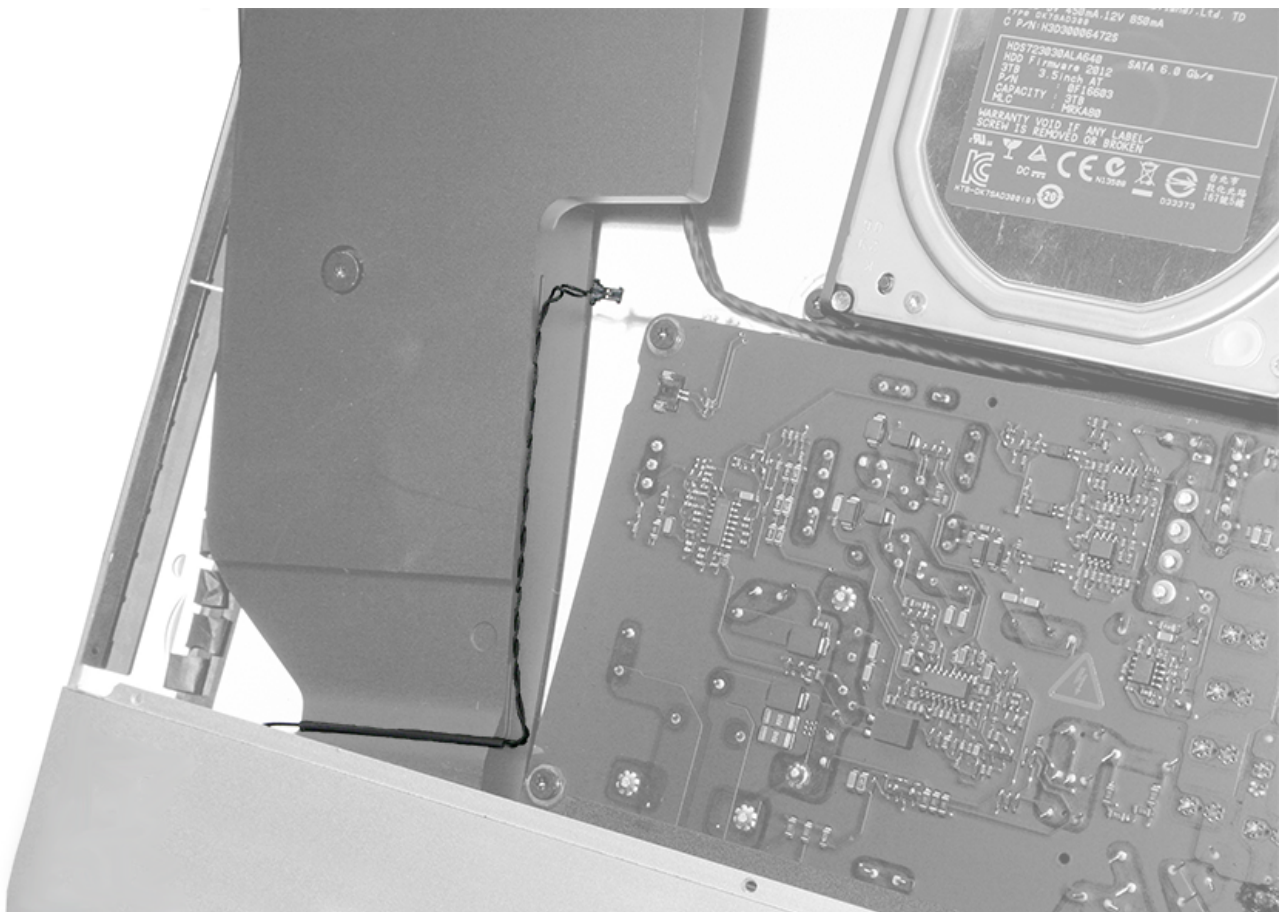




3. Pull the speaker forward, then push in on the lower end of the speaker (to clear the rear housing). Lift the speaker up and off to the side until the power button cable is visible.



4. Gently remove the power button cable from the routing groove on the side and the lower end of the speaker.



5. Tilt the speaker to the left.

**Note:** On the iMac (Late 2012 and Late 2013) models, the hard drive must be removed to disconnect the left speaker cable from the logic board. Follow steps 6 and 7 to remove the hard drive. On the iMac (Retina 5K, 27-inch, Late 2014) model, the hard drive does not need to be removed to access the speaker cable connector on the logic board. Proceed to removal step 8.



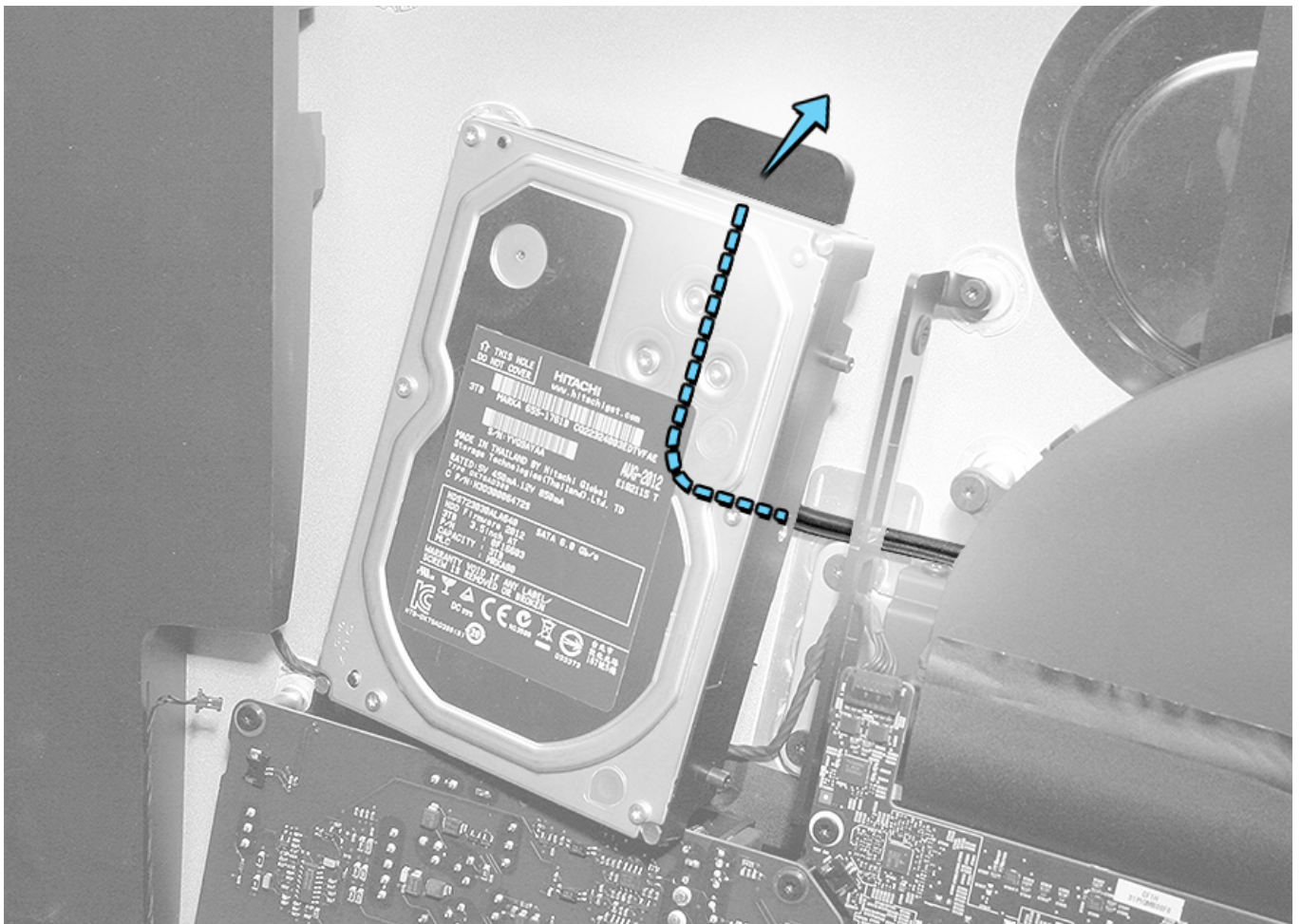
6. Support the hard drive with one hand. Remove two (2) T10 screws from the left mounting bracket.



- 923-0331



7. Disconnect the data and power cable from the top of the hard drive. Slide the hard drive out of the right mounting bracket.



8. Disconnect the speaker cable from the logic board. Lift the speaker out of the rear housing.

**Note:** The speaker cable runs under the hard drive and the right hard drive bracket. On reassembly, tuck the excess cable under the hard drive or power supply.



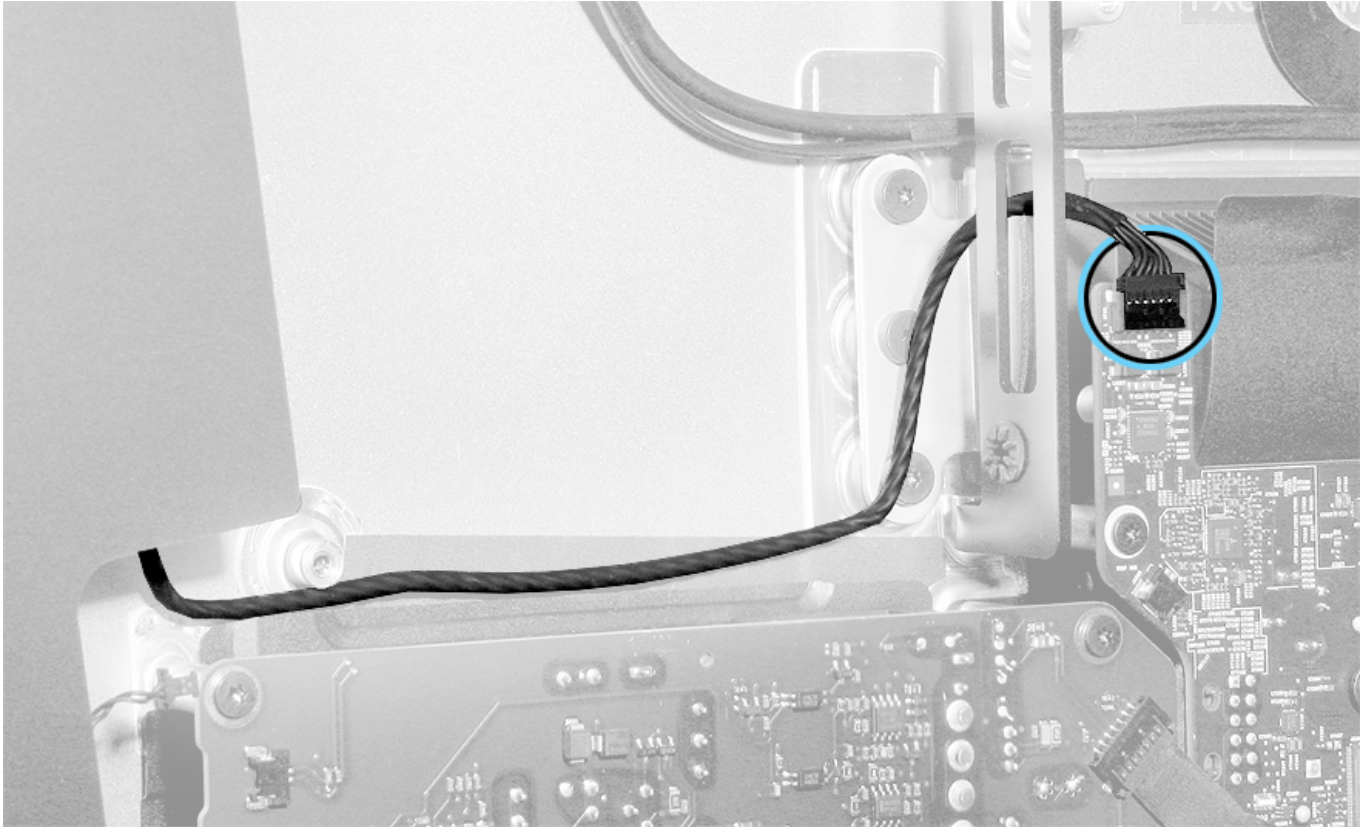
## Steps For Reassembly

1. Install the power button cable into its routing groove on the left speaker. **Important:** If the power button cable breaks, the

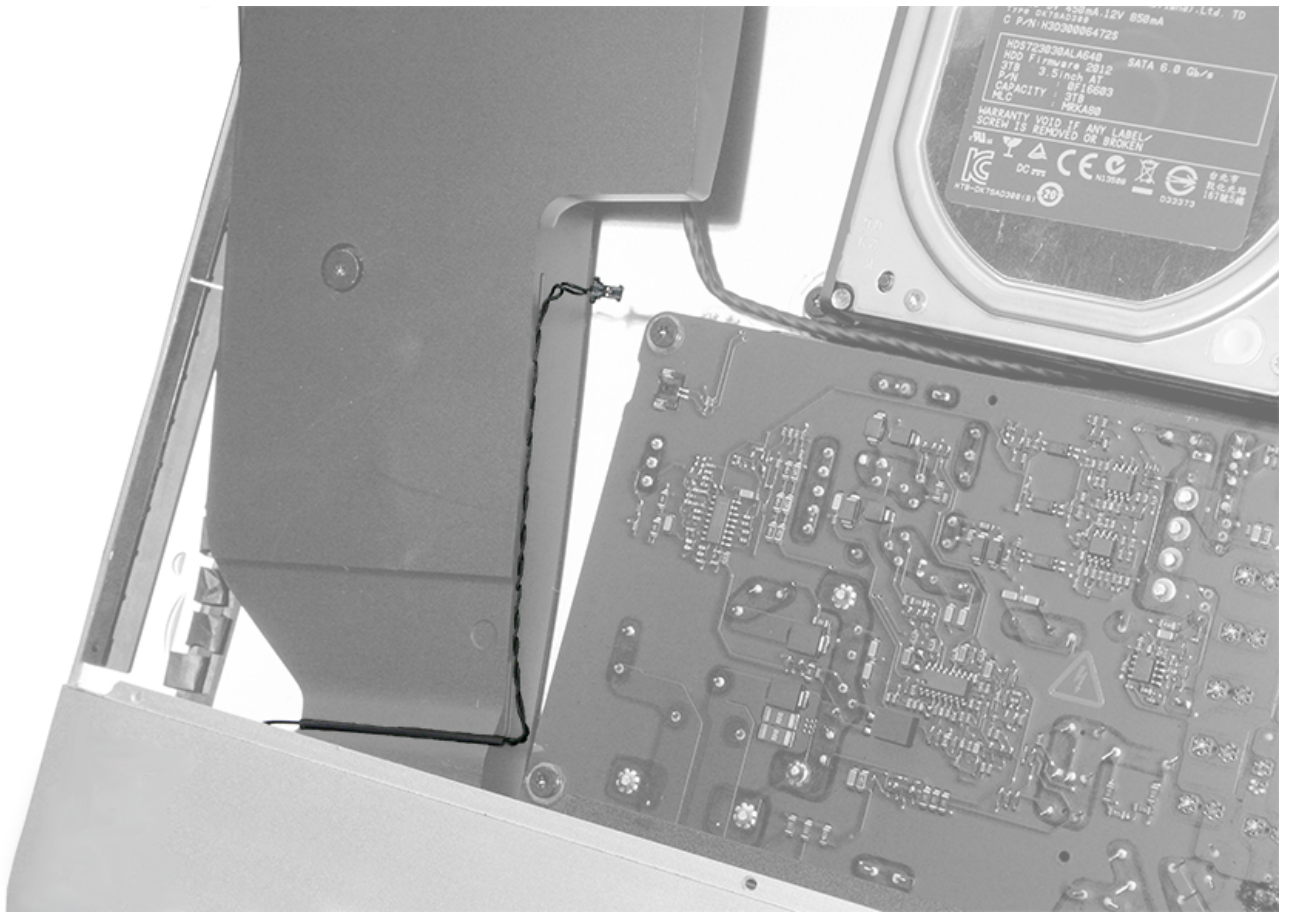


rear housing will require replacement. The power button cable is part of the rear housing.

2. On the iMac (Late 2012 and Late 2013) models, install the left mounting bracket and hard drive. If you are repairing an iMac (Retina 5K, 27-inch, Late 2014), go to the next step.
3. On the iMac (Late 2012 and Late 2013) models, route the speaker cable along the top edge of the power supply and under the right mounting bracket. On the iMac (Retina 5K, 27-inch, Late 2014), route the speaker cable around the top edge of the power supply and along the right side of the right mounting bracket.
4. Connect the speaker cable to the logic board.



5. Position the speaker in the rear housing. Ensure that the power button cable does not bind or slip out of the routing groove as you place the speaker into the rear housing.

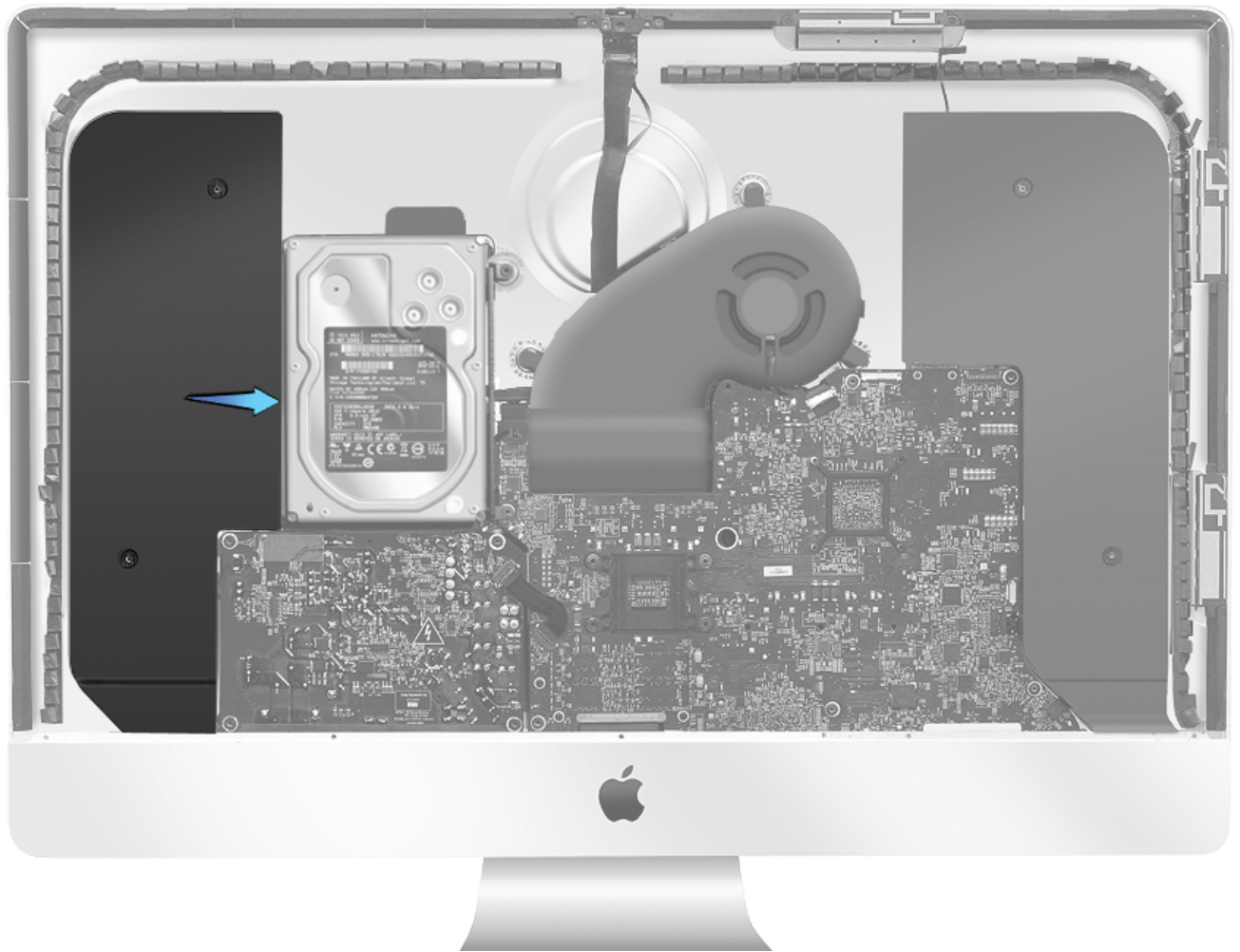


6. Lower the speaker the rest of the way into the rear housing.





7. Correct spacing between the left speaker and hard drive requires inserting a 1.85mm shim between the left speaker and hard drive (shown by the arrow below). Stack 18 individual sticky notes to make a 1.85mm shim. Insert the shim between the speaker and hard drive. Tighten the speaker screws after inserting the shim.

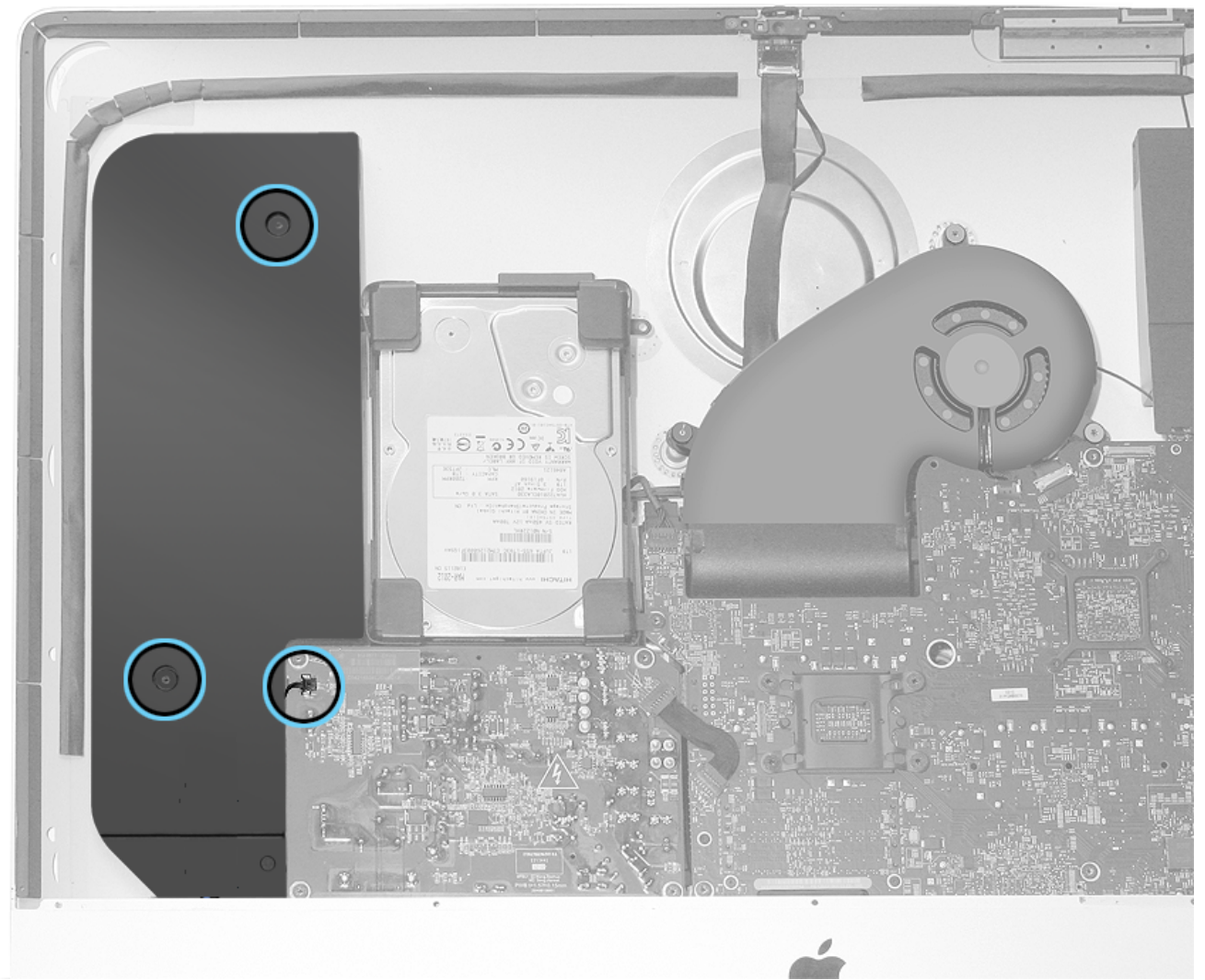


8. Connect the power button to the power supply.

9. Install two (2) T10 screws.

- 923-0333 (10 mm)





# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Hard Drive

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV244: Hard Drive Replacement Video](#).

Remove:

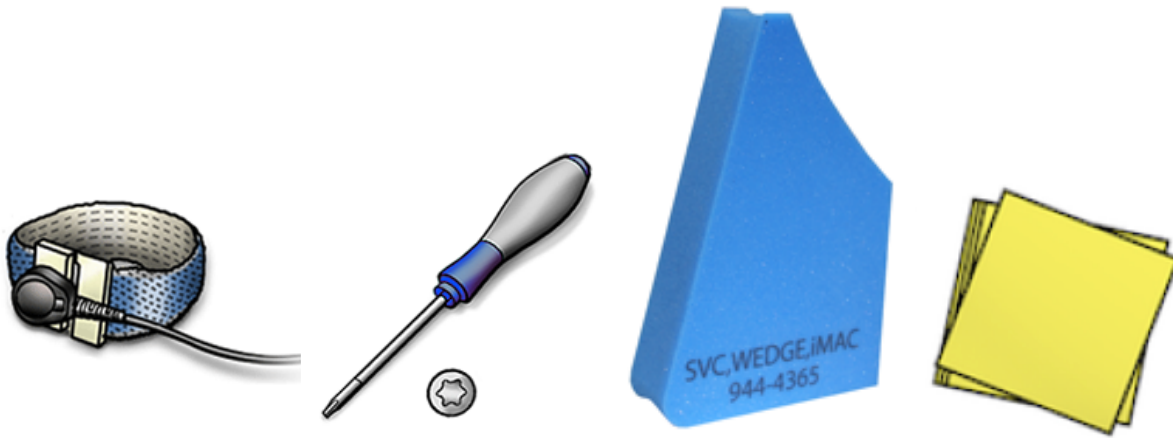
- [Display panel](#)
- [Display panel VHB strips](#)
- [Left speaker](#) (partial removal)



## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Torx T8 screwdriver (magnetized)
- Service wedge (iMac)
- Sticky notes





## Steps For Removal

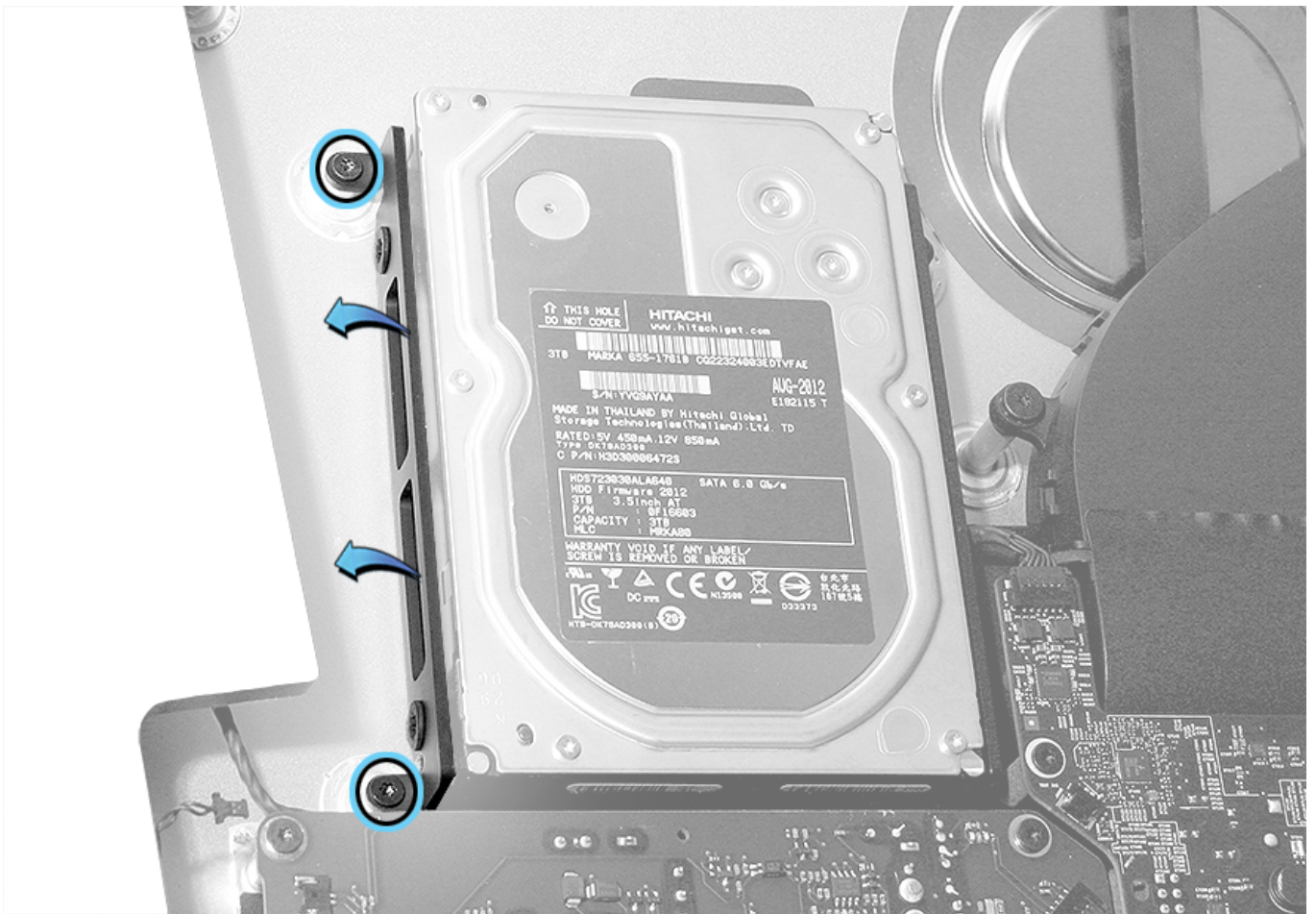
1. Do a partial removal of the left speaker to access the left hard drive bracket (the next step).



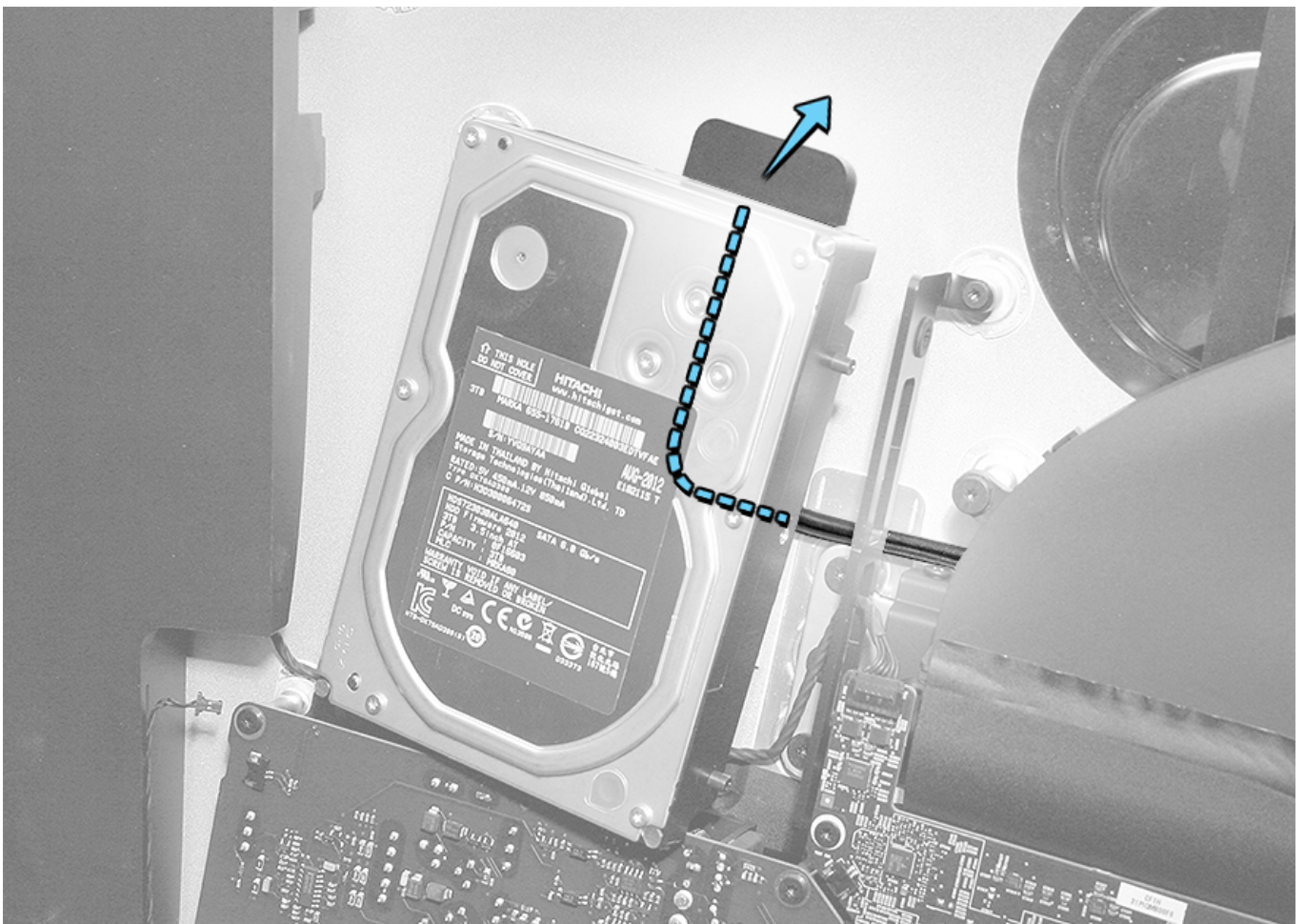
2. Supporting the hard drive with one hand, remove two (2) T10 screws from the left mounting bracket. Slide the hard drive out of the rubber grommets on the right mounting bracket.

- 923-0331





3. Disconnect the hard drive data cable from the top of the hard drive.



**Steps For Reassembly**



1. If installing a replacement hard drive, transfer the four (4) T8 screw pins.

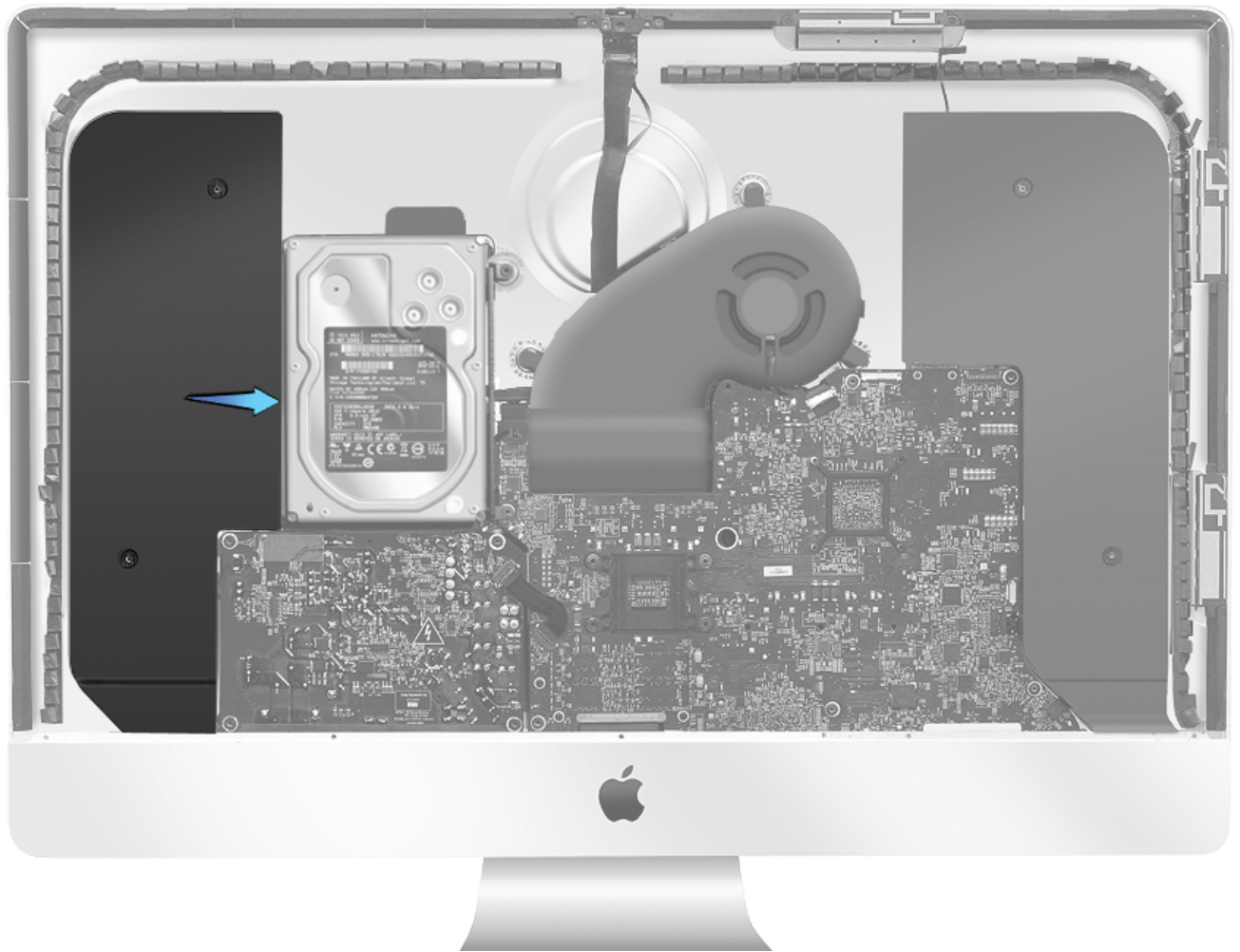


2. Route the hard drive cable along the top edge of the logic board. The cable should lay flat under the hard drive.





3. Connect the hard drive cable.
4. Reinstall the hard drive bracket and bracket screws.
5. Lower the left speaker into the rear housing.
6. Connect the power-on cable to the power supply.
7. Correct spacing between the left speaker and hard drive requires inserting a 1.85mm shim between the left speaker and hard drive (shown by arrow below). Stack 18 individual sticky notes to make a 1.85mm shim. Insert the shim between the speaker and hard drive. Tighten the speaker screws after inserting the shim.



8. Reinstall the [chin strap](#).
9. Reinstall the [display panel](#).
10. Refer to Apple Support article [TP767: Reinstalling Software That Came with the Computer](#).

# Portables and Desktops (Late 2011 or later): Reinstalling Software That Came with the Computer

Refer to Apple Support article [HT4718: OS X: About OS X Recovery](#) for more information.

A connection to the Internet is required to complete this procedure.

**Note:** In some situations, a customer may have set an EFI password via a feature such as Find My Mac or FileVault. The customer must know the EFI password in order to perform a Mac OS X reinstall.

If you suspect that an EFI password was set, and the customer cannot remember the password, contact TCS for assistance using their normal escalation path. Refer to Apple Support article [TS3554: Recovering a lost firmware password](#) for more information about resetting EFI passwords.

**Important:** Apple recommends that customers back up data before any software restore procedure. Back up essential files before installing OS X and other applications. Apple is not responsible for any loss of data.

1. Choose Apple menu > Restart, then hold down the Command (⌘) and R keys while the computer restarts.  
**Note:** To force OS X Lion or OS X Mountain Lion into Internet Recovery, press and hold the Command-Option-R key combination while starting up the computer.
2. If the computer is not connected to the Internet, choose a network from the Wi-Fi menu (in the top-right corner of the screen).
3. Select "Reinstall OS X", then click Continue.
4. Follow the onscreen instructions. In the pane where you select a disk, select your current OS X disk (in most cases, it is the only one available).
5. To start the installation, click Install.

Check for and apply the latest software and firmware updates.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Bluetooth Antenna, Upper

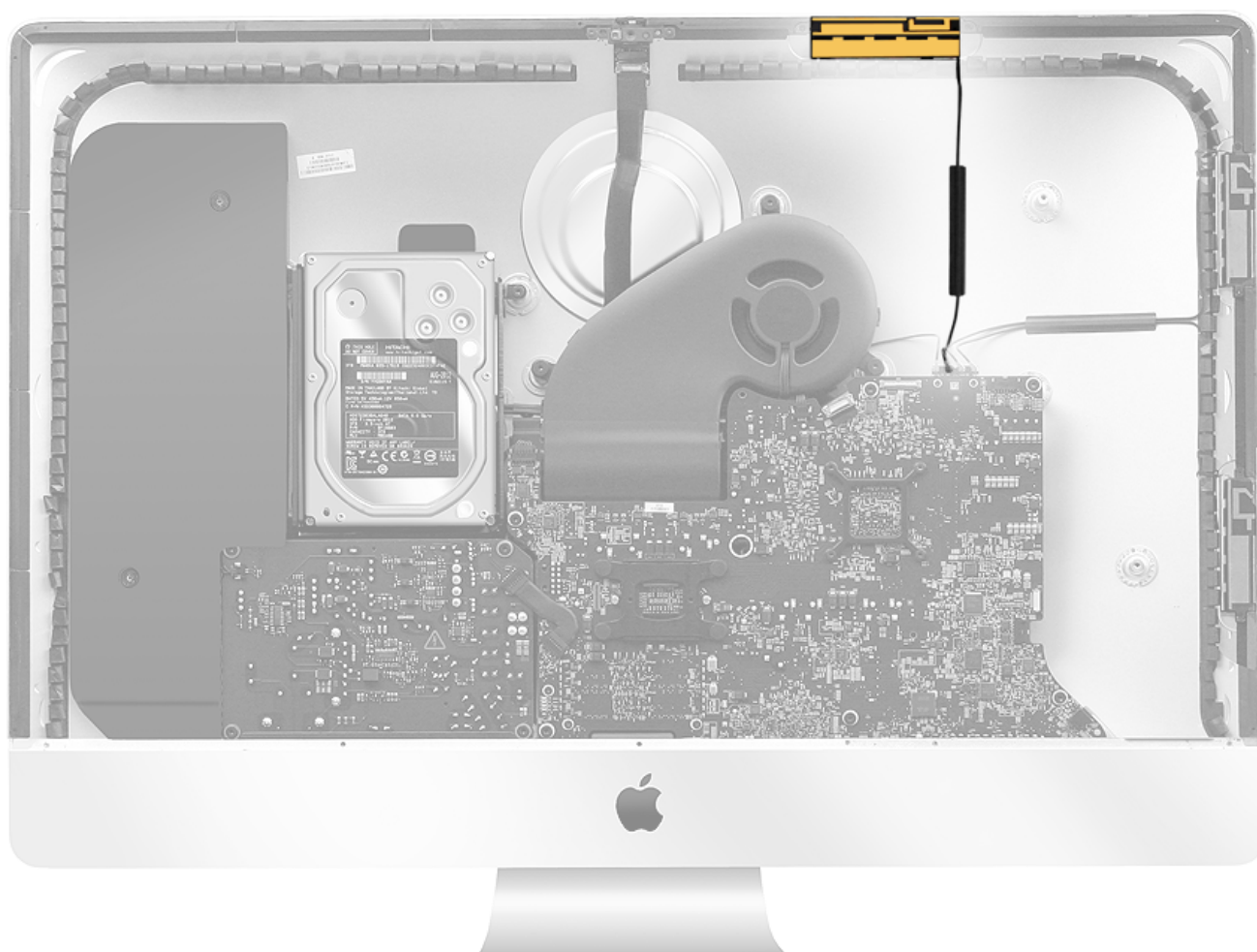
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

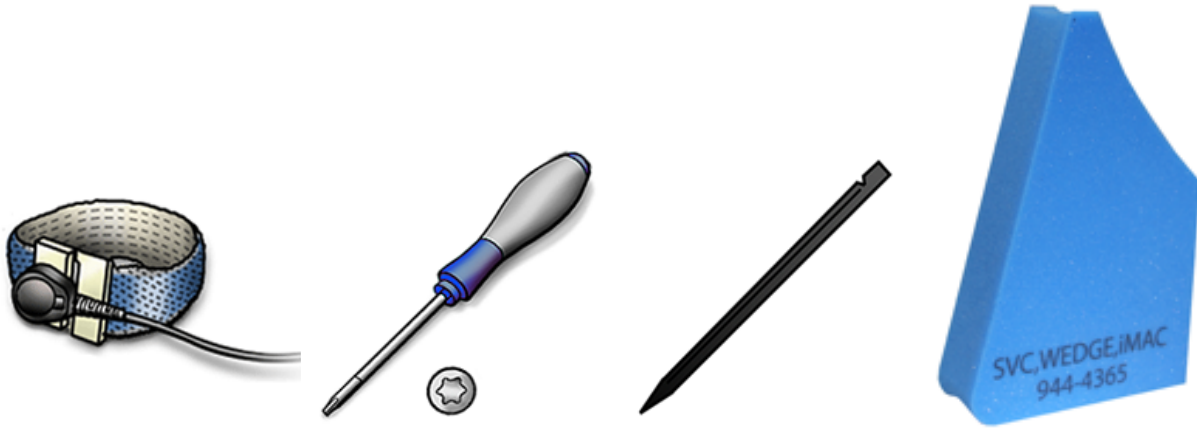
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



## Tools

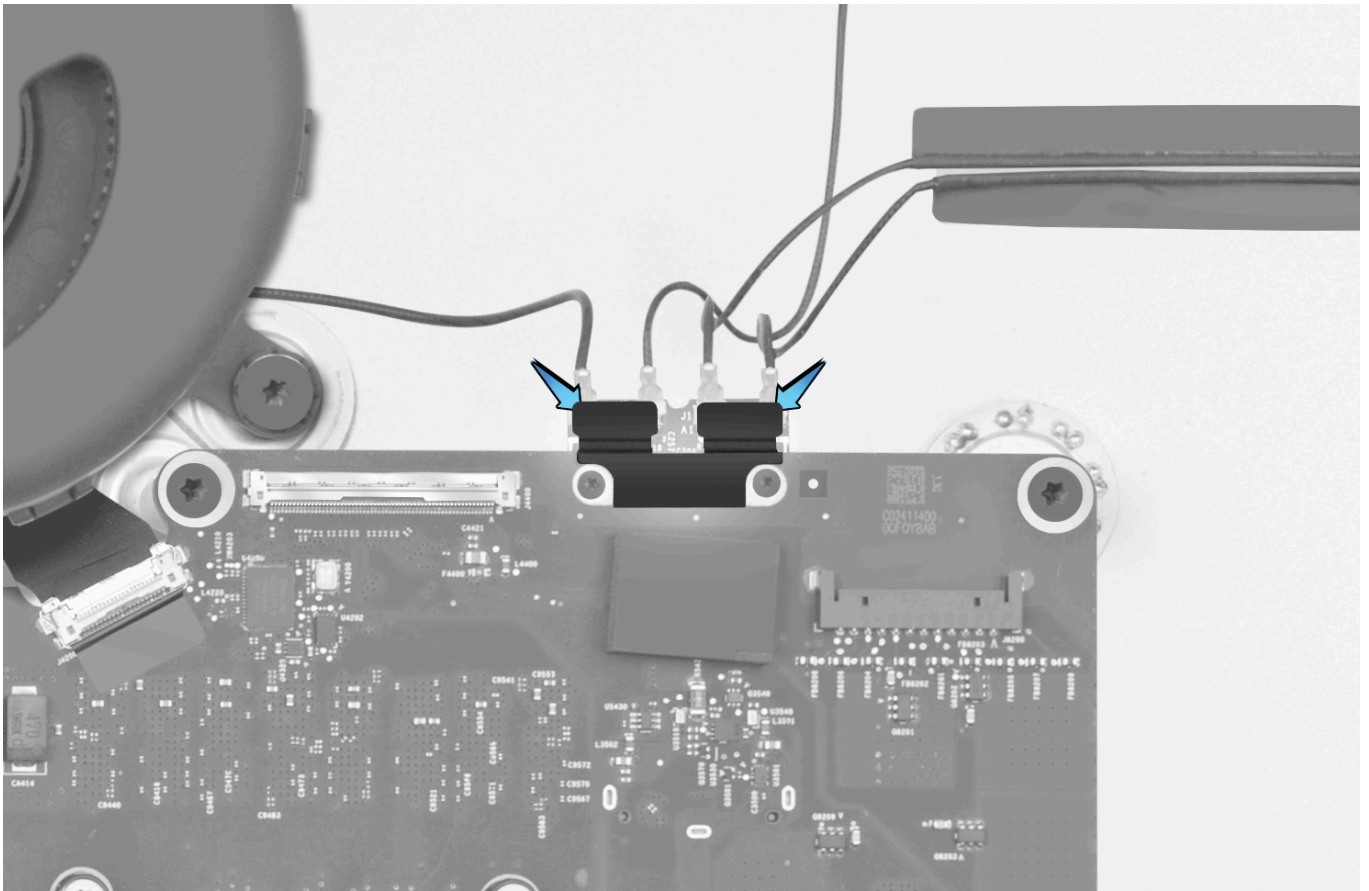
- ESD wrist strap and mat
- Torx T4 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



## Steps For Removal

**Note:** The iMac has four (4) Wi-Fi/Bluetooth antennas, three (3) of which are removable. The fourth resides inside the Apple logo in the rear housing and can only be replaced by replacing the rear housing.

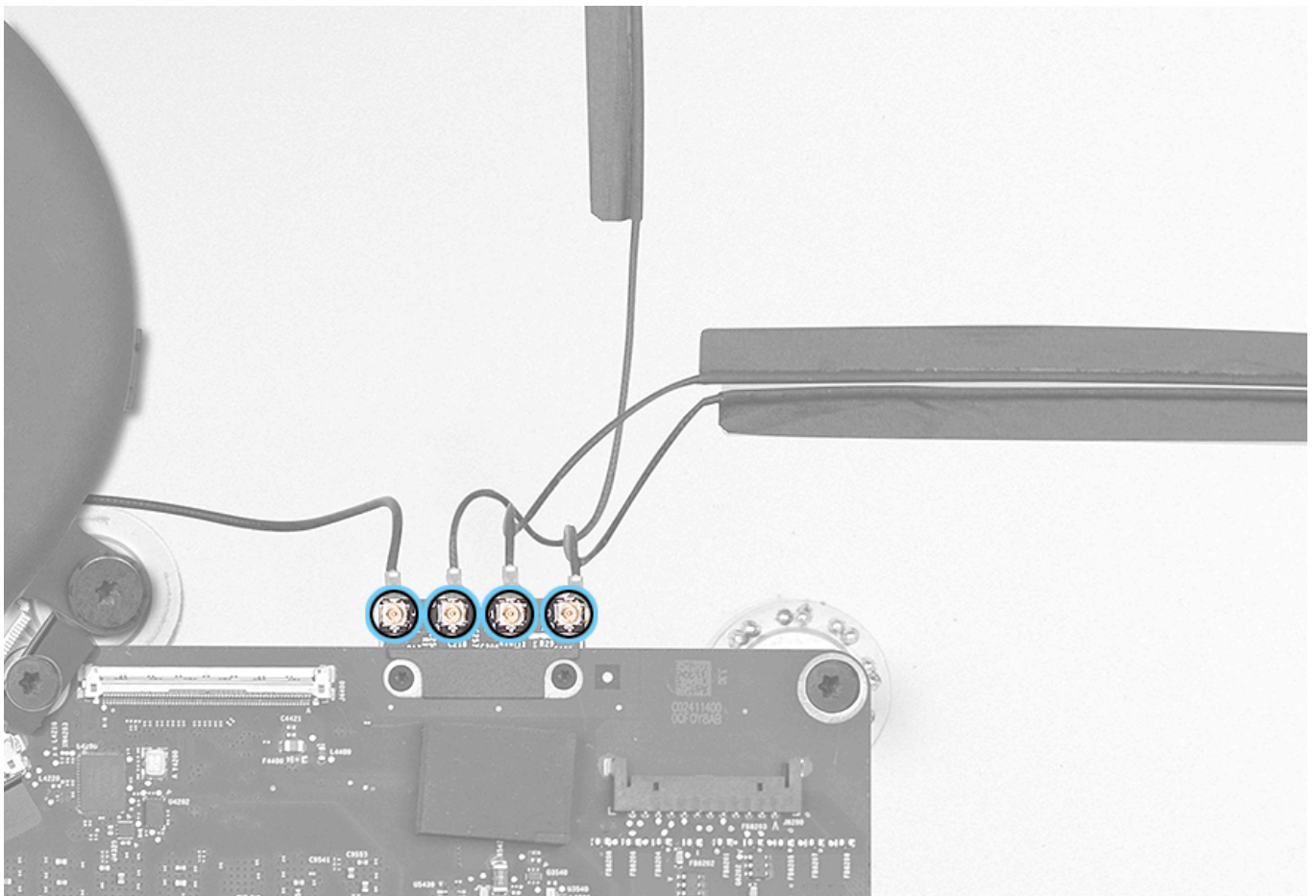
1. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick to peel down the tape that covers the antenna cable connectors.



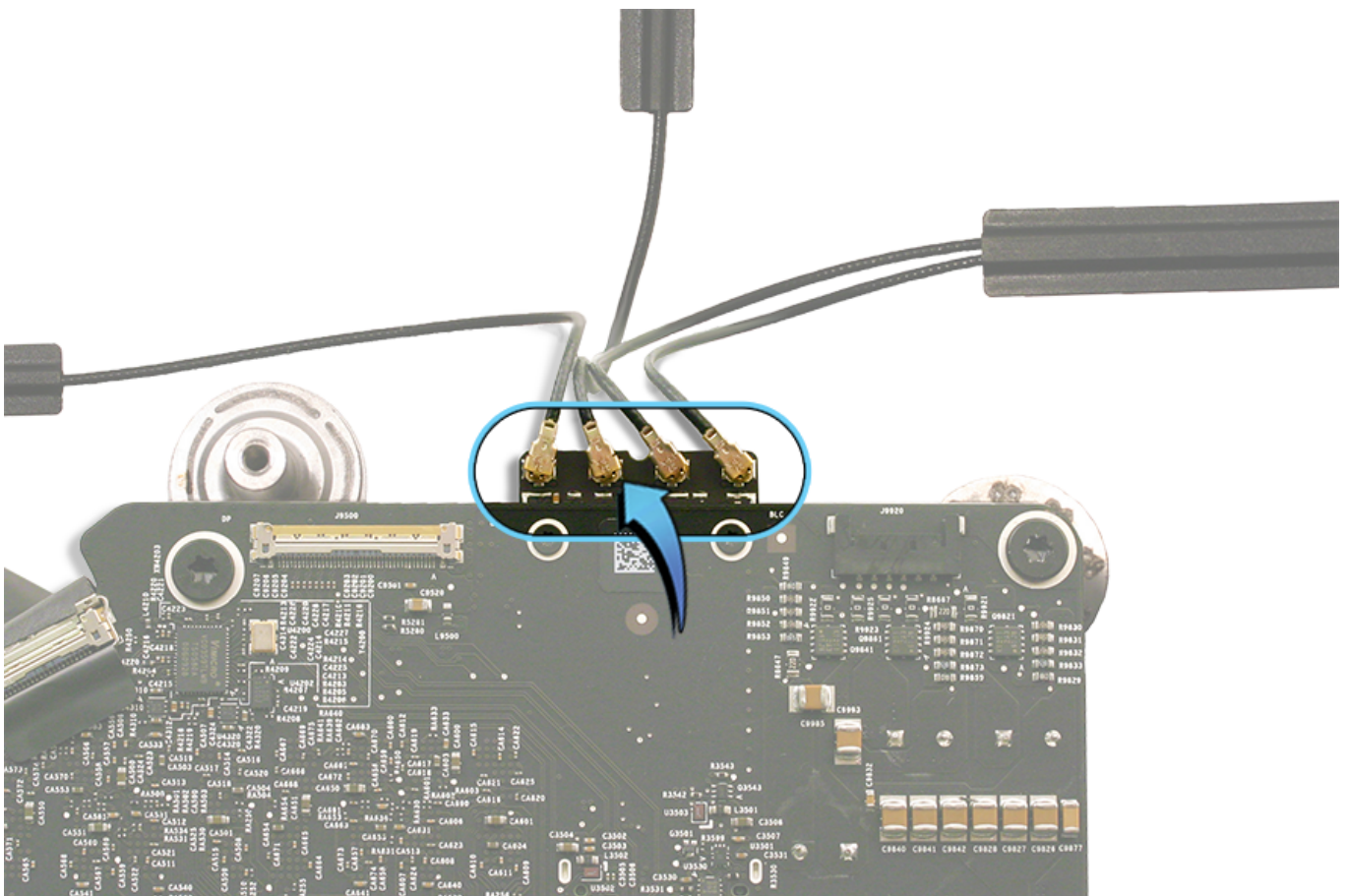
2. On the wireless card, disconnect the antenna that is second from the left.

**iMac (Retina 5K, 27-inch, Late 2014)**





iMac (27-inch, Late 2012 and Late 2013)



3. Remove two (2) T4 antenna screws.

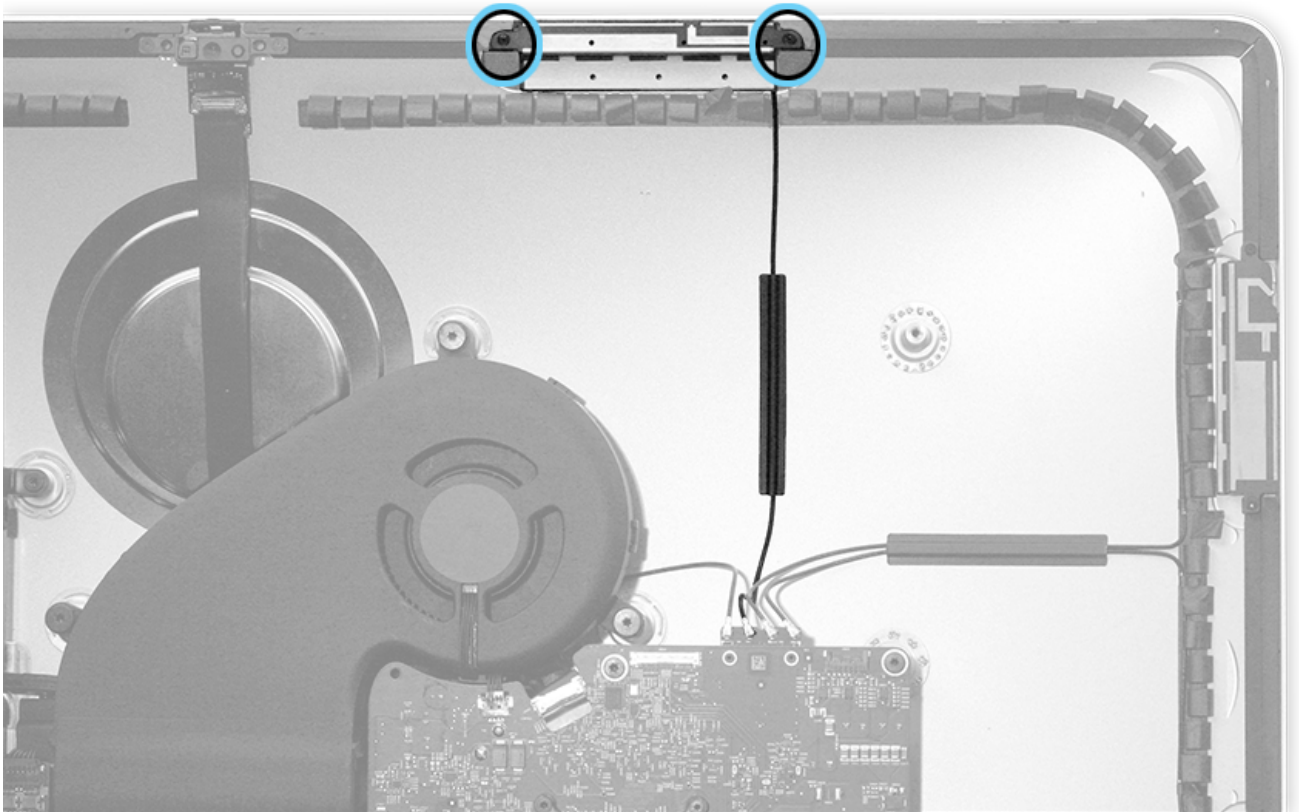
- 923-0304





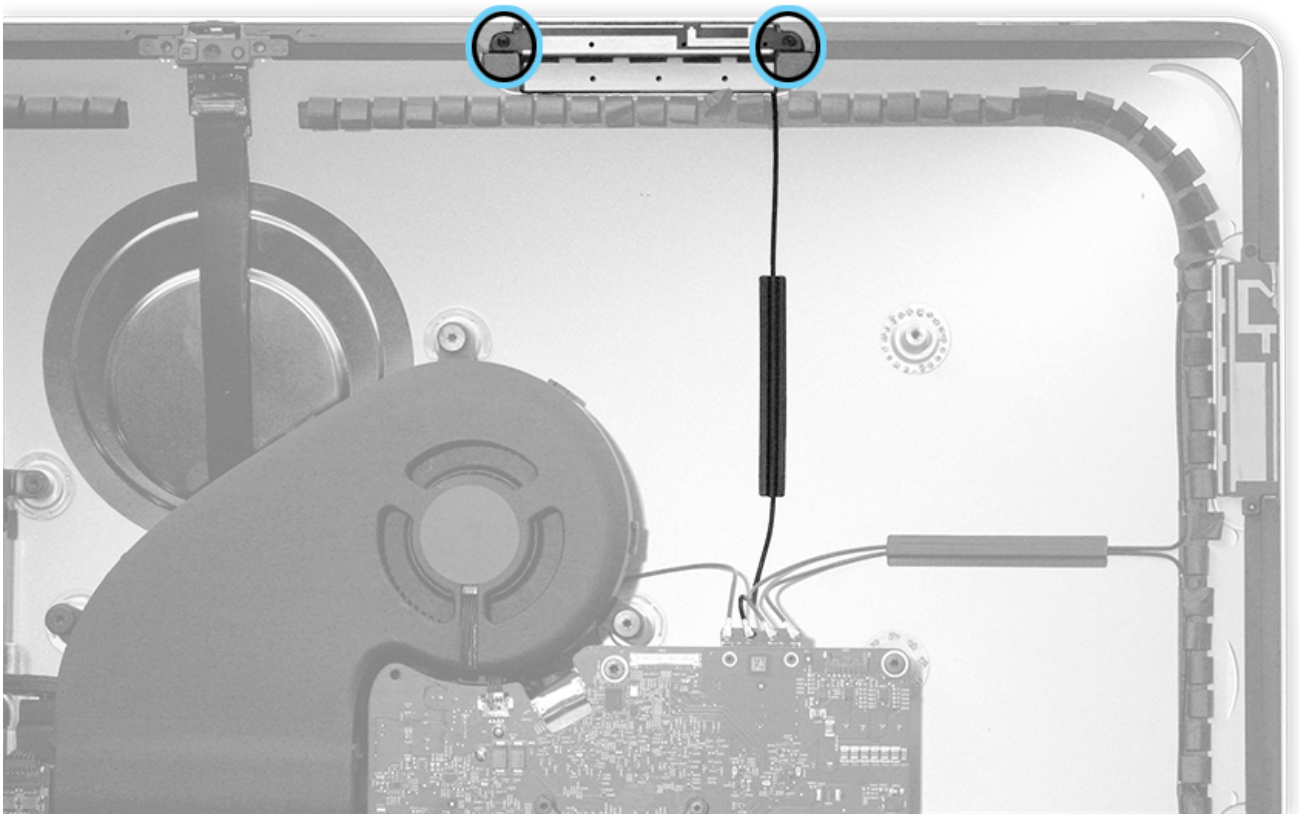
4. With a black stick:

- Peel up the tiny piece of Mylar tape that secures the antenna cable (located within the airloop gasket running alongside the antenna) to the rear housing.
- Pry up the black tape to free the antenna cable from the rear housing.



### Steps For Reassembly

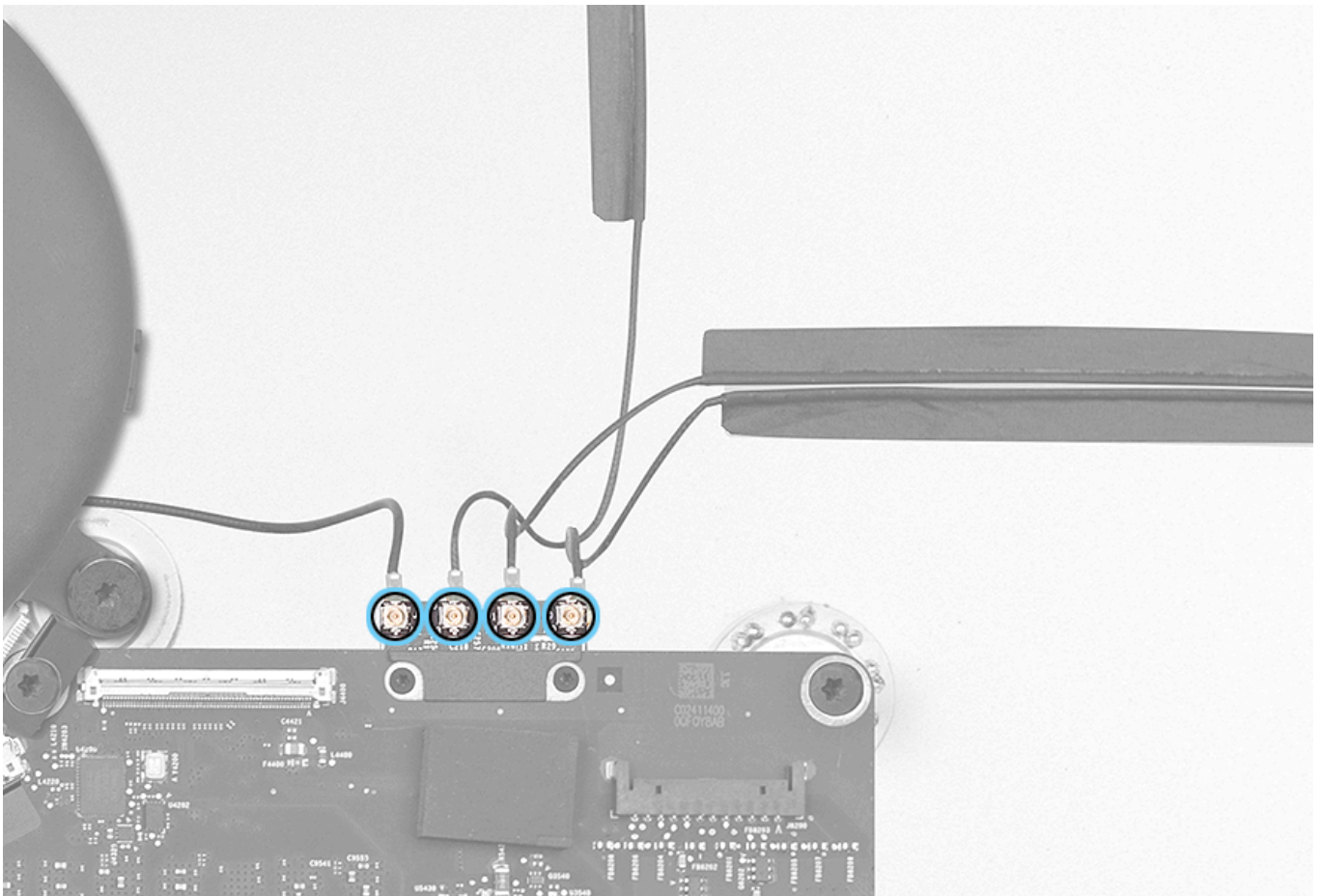
1. Install two (2) antenna screws to the Wi-Fi antenna.
2. Use a black stick to adhere any pieces of Mylar tape located within the airloop gasket that runs alongside the antenna.



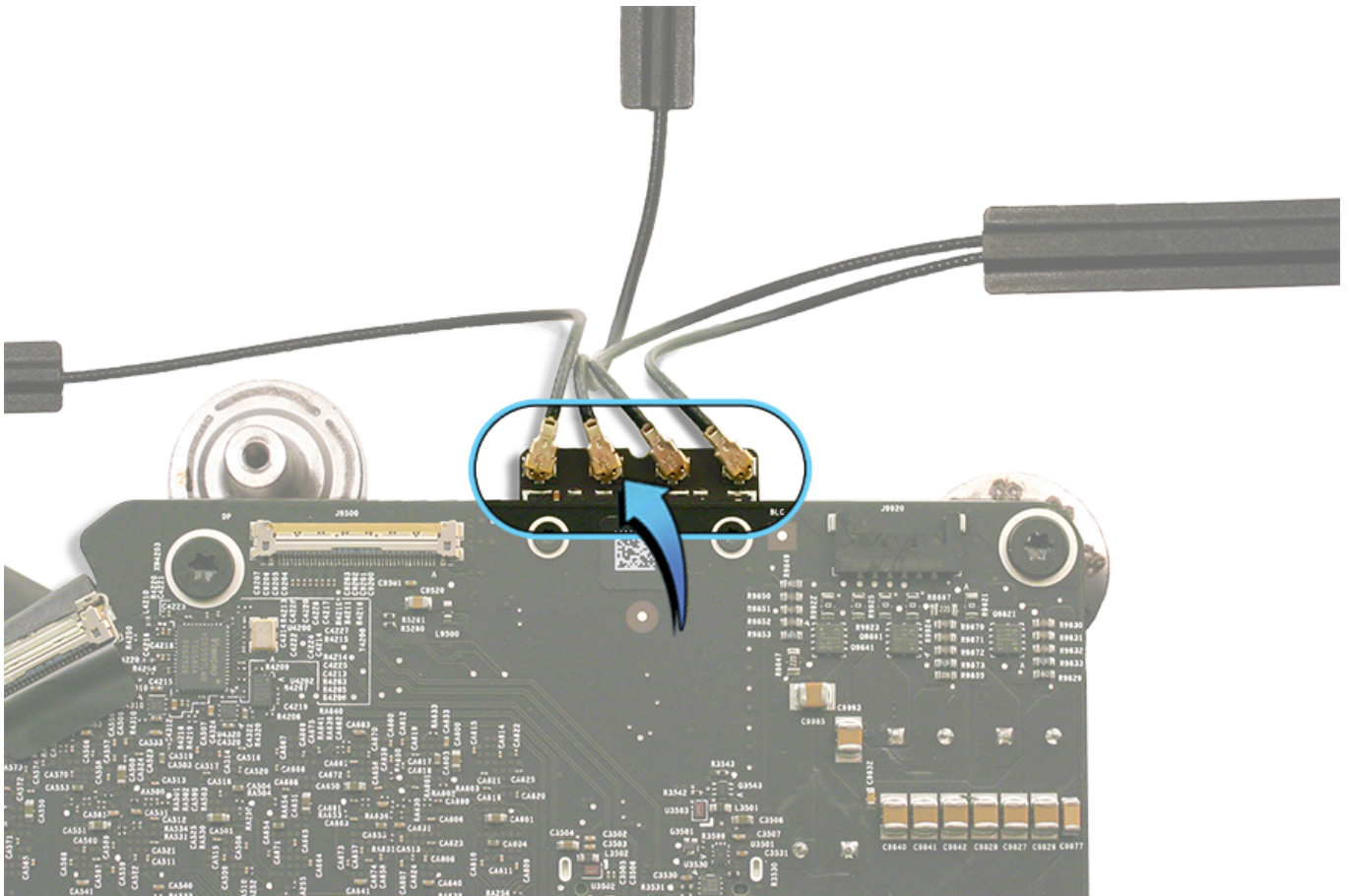
3. Connect the antenna to the second connector from the left on the wireless card.

**Note:** If installing a replacement antenna, peel the backing off of the Mylar tape and stick the antenna to the rear housing.

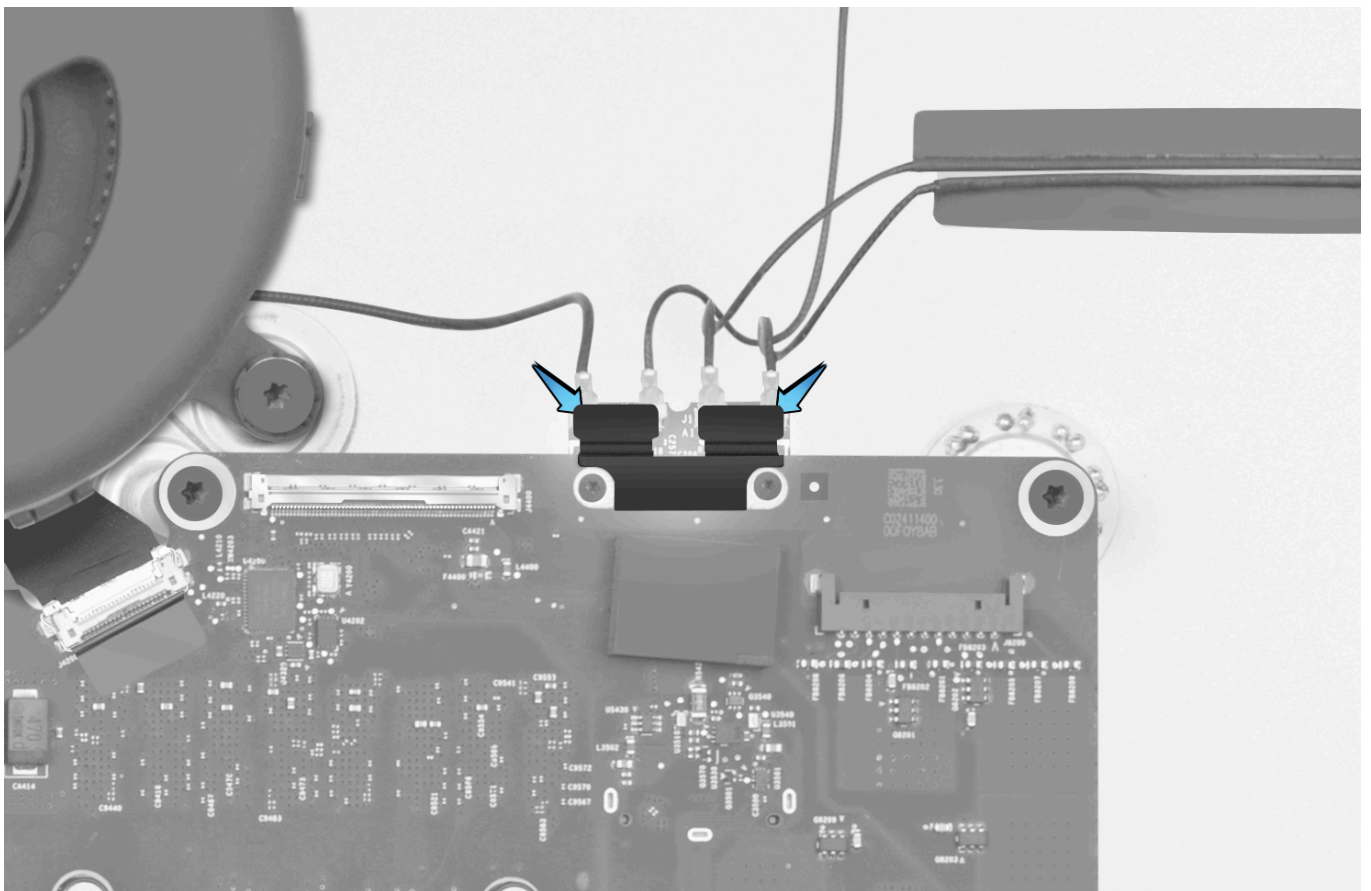
#### iMac (Retina 5K, 27-inch, Late 2014)



#### iMac (27-inch, Late 2012 and Late 2013)



4. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick or your finger to press the Mylar tape onto the antenna cable connectors.





# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Wi-Fi Antenna, Mid

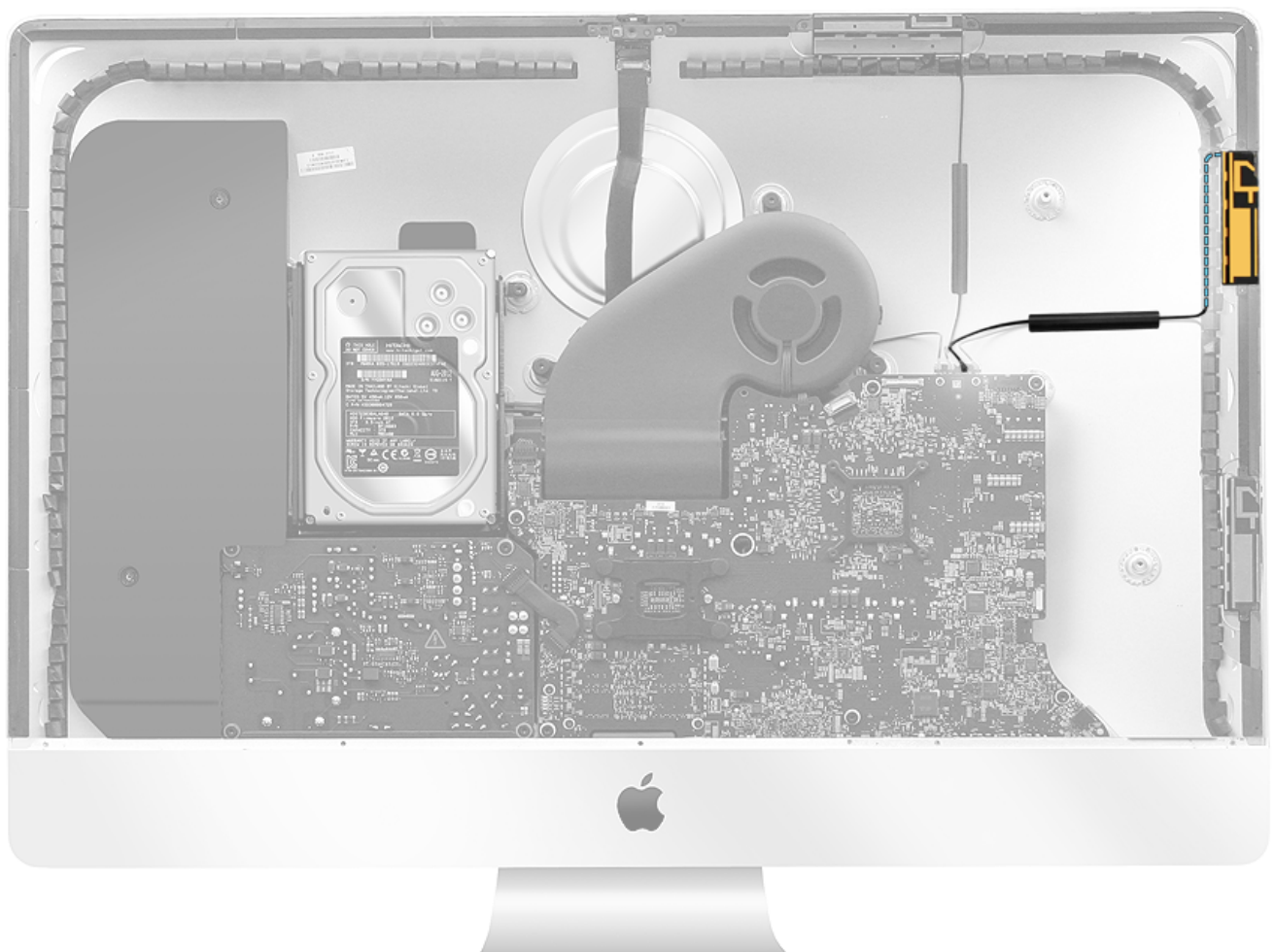
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

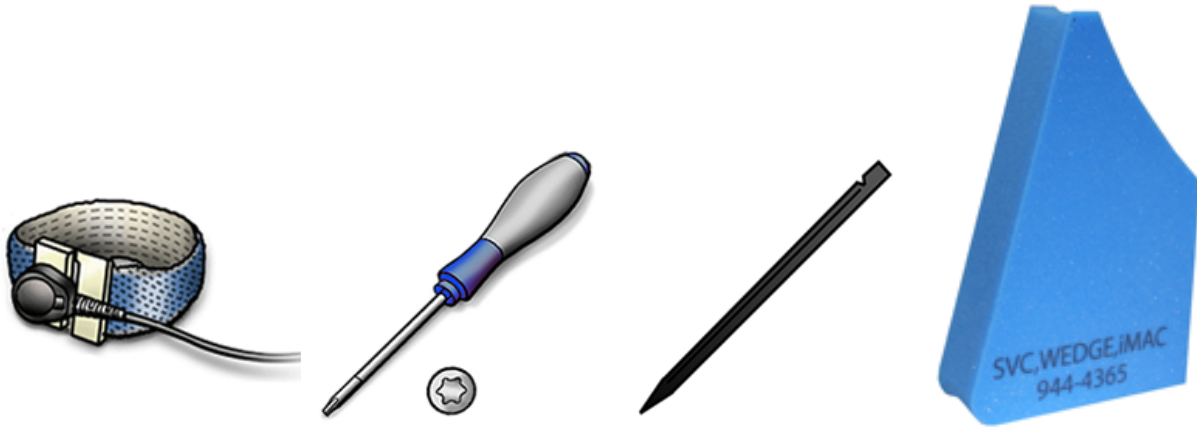
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



## Tools

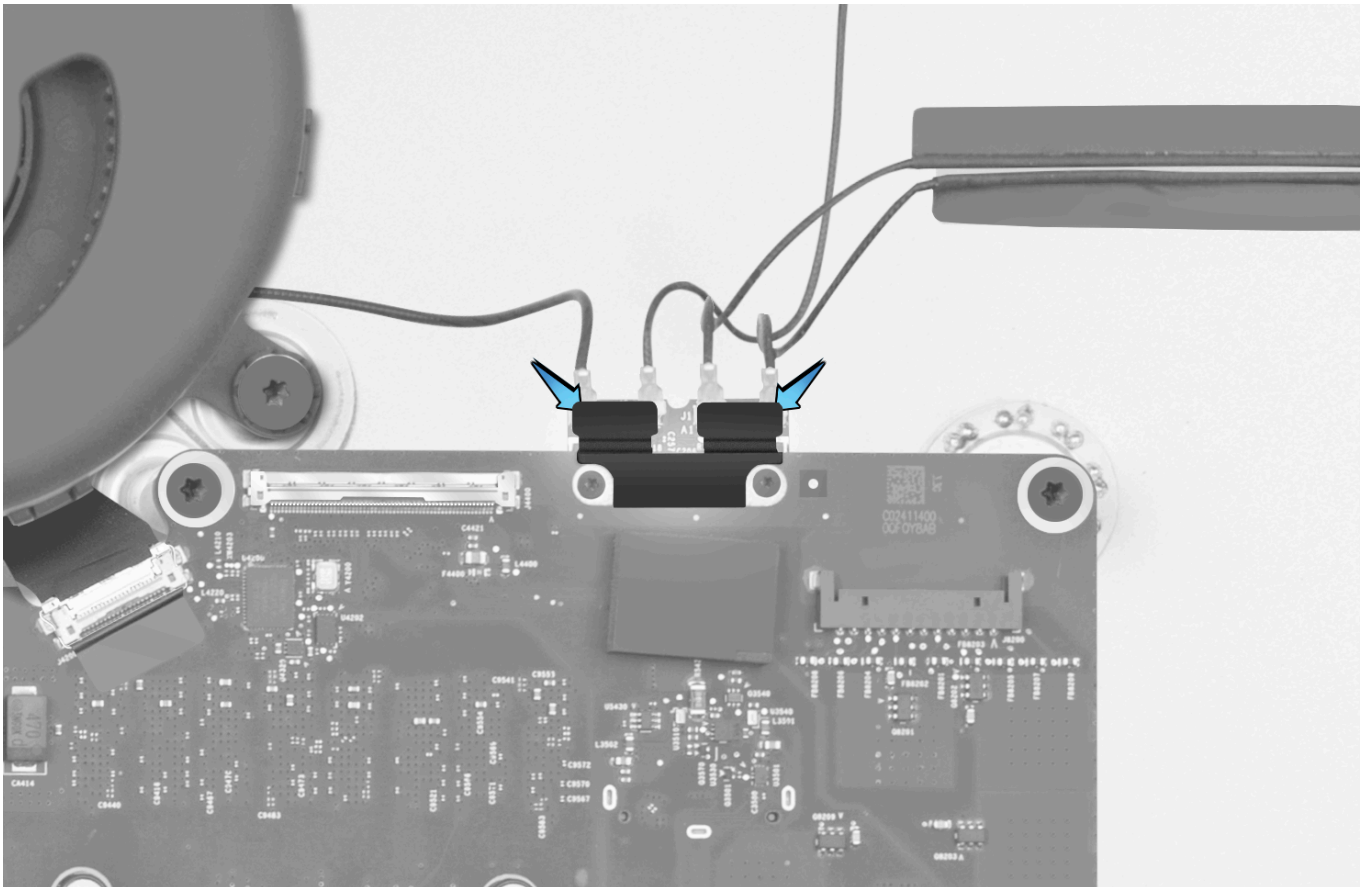
- ESD wrist strap and mat
- Torx T4 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



## Steps For Removal

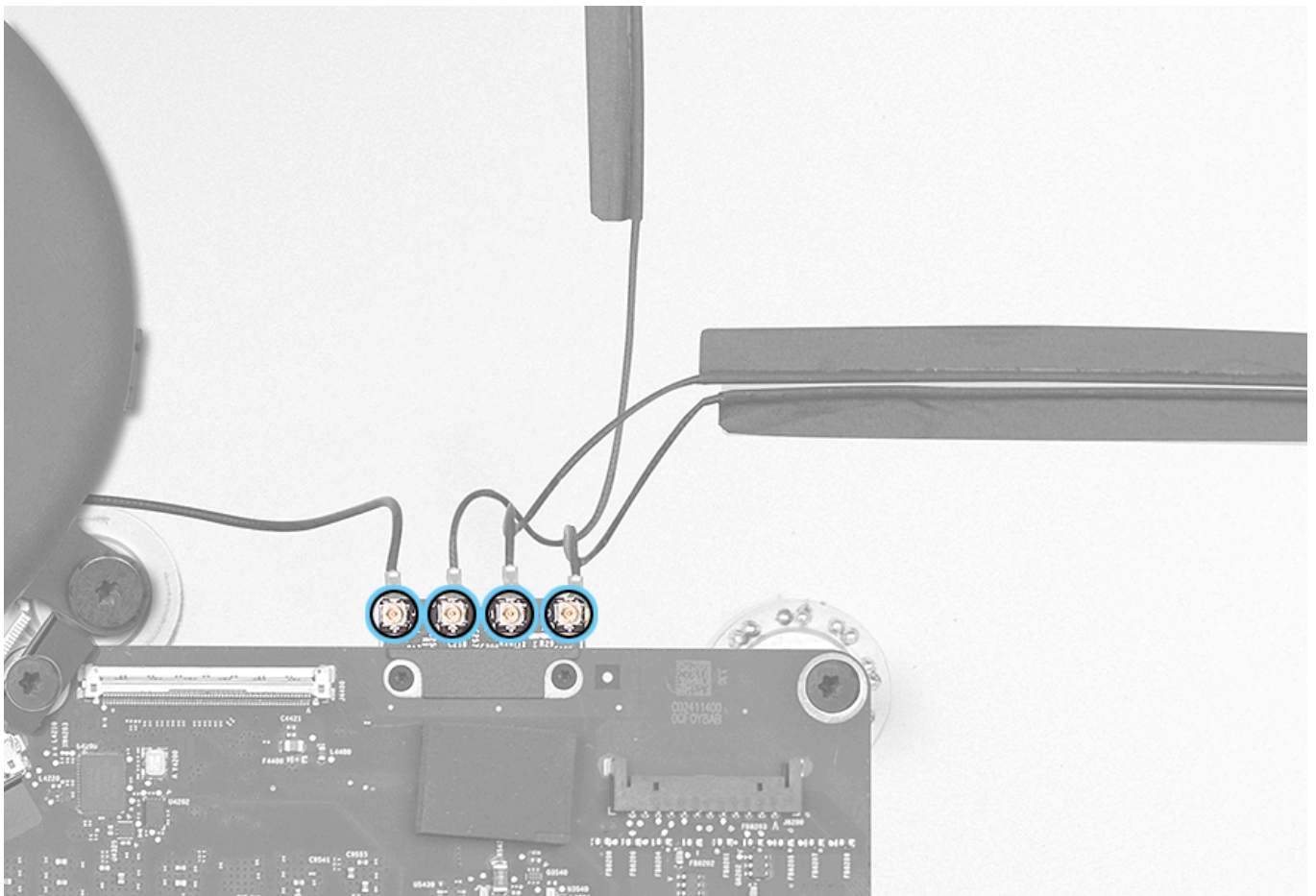
**Note:** The Mac has four (4) Wi-Fi/Bluetooth antennas, three (3) of which are removable. The fourth resides inside the Apple logo in the rear housing and can only be replaced by replacing the rear housing.

1. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick to flip down the tape that covers the antenna cable connectors.

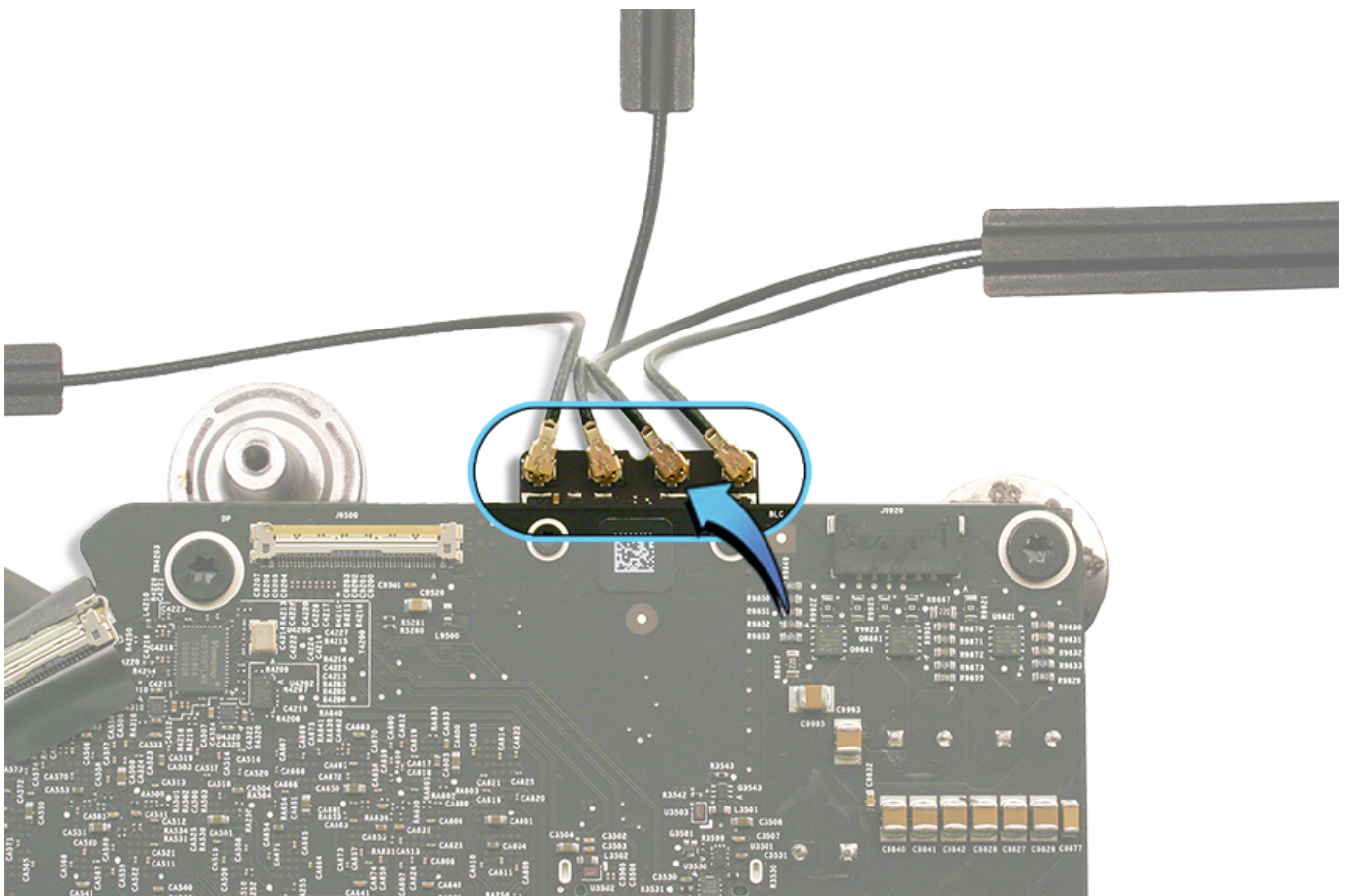


2. On the wireless card, disconnect the antenna that is second from the right.

**iMac (Retina 5K, 27-inch, Late 2014)**



iMac (27-inch, Late 2012 and Late 2013)



3. Remove two (2) T4 antenna screws.

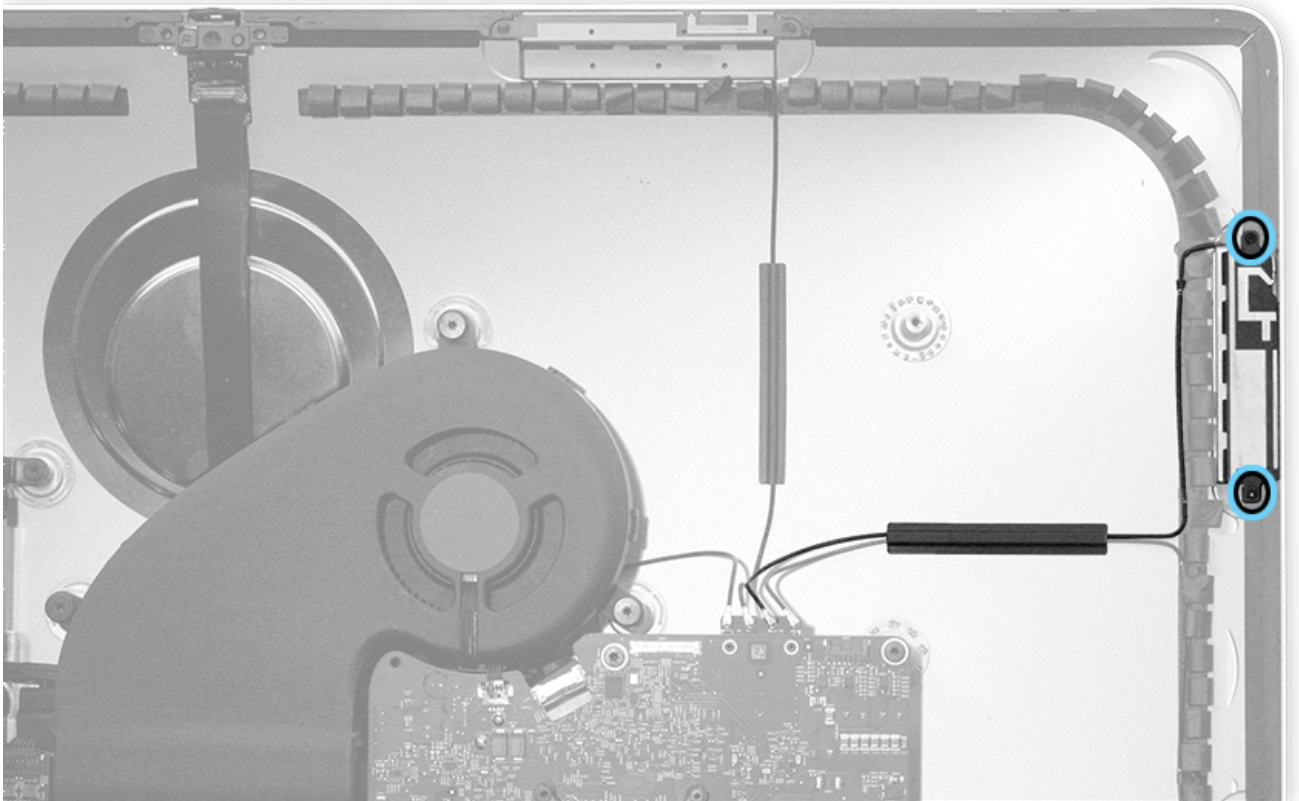
- 923-0304





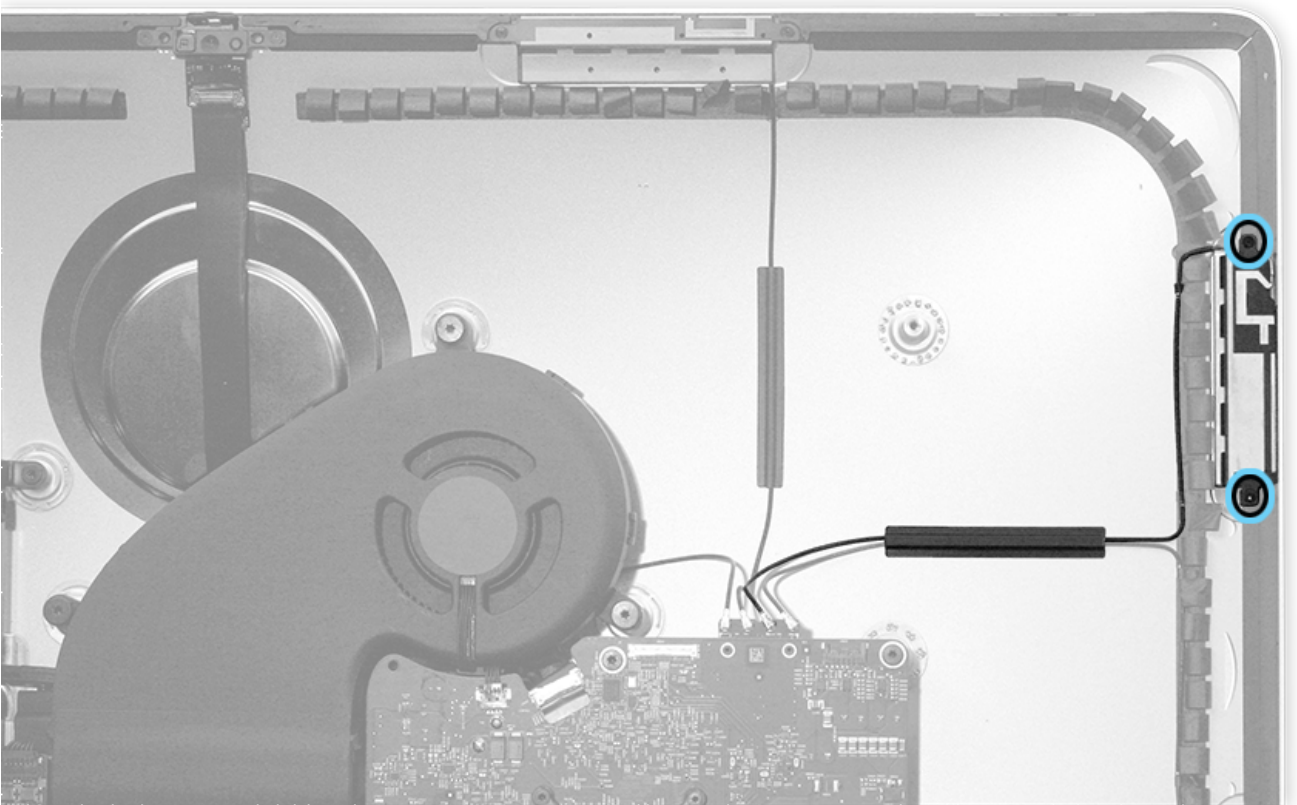
4. With a black stick:

- Peel up the tiny piece of Mylar tape that secures the antenna cable (located within the airloop gasket running alongside the antenna) to the rear housing.
- Pry up the black tape to free the antenna cable from the rear housing.



### Steps For Reassembly

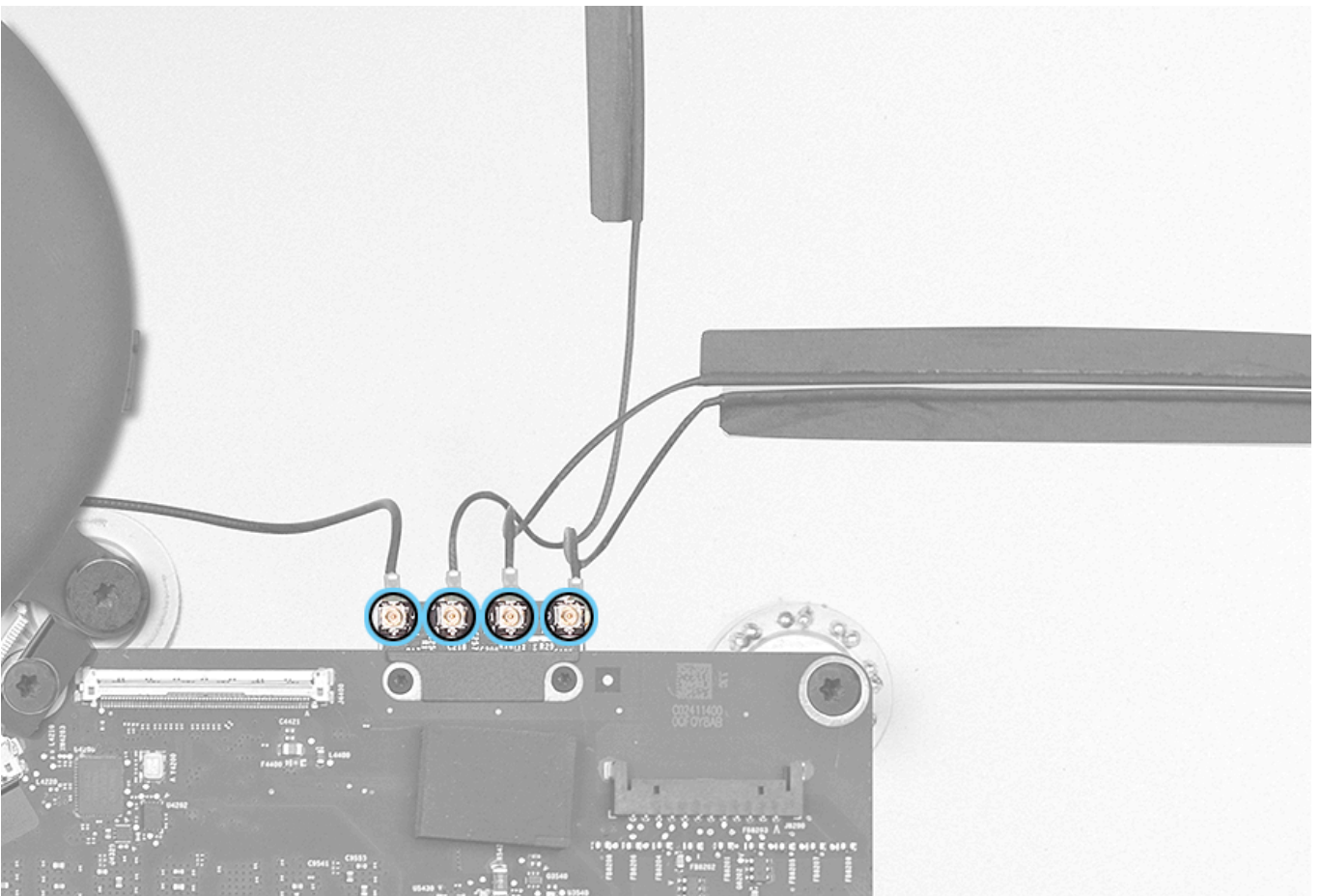
1. Install two (2) antenna screws to the Wi-Fi antenna.
2. Use a black stick to adhere any pieces of Mylar tape located within the airloop gasket that runs alongside the antenna.



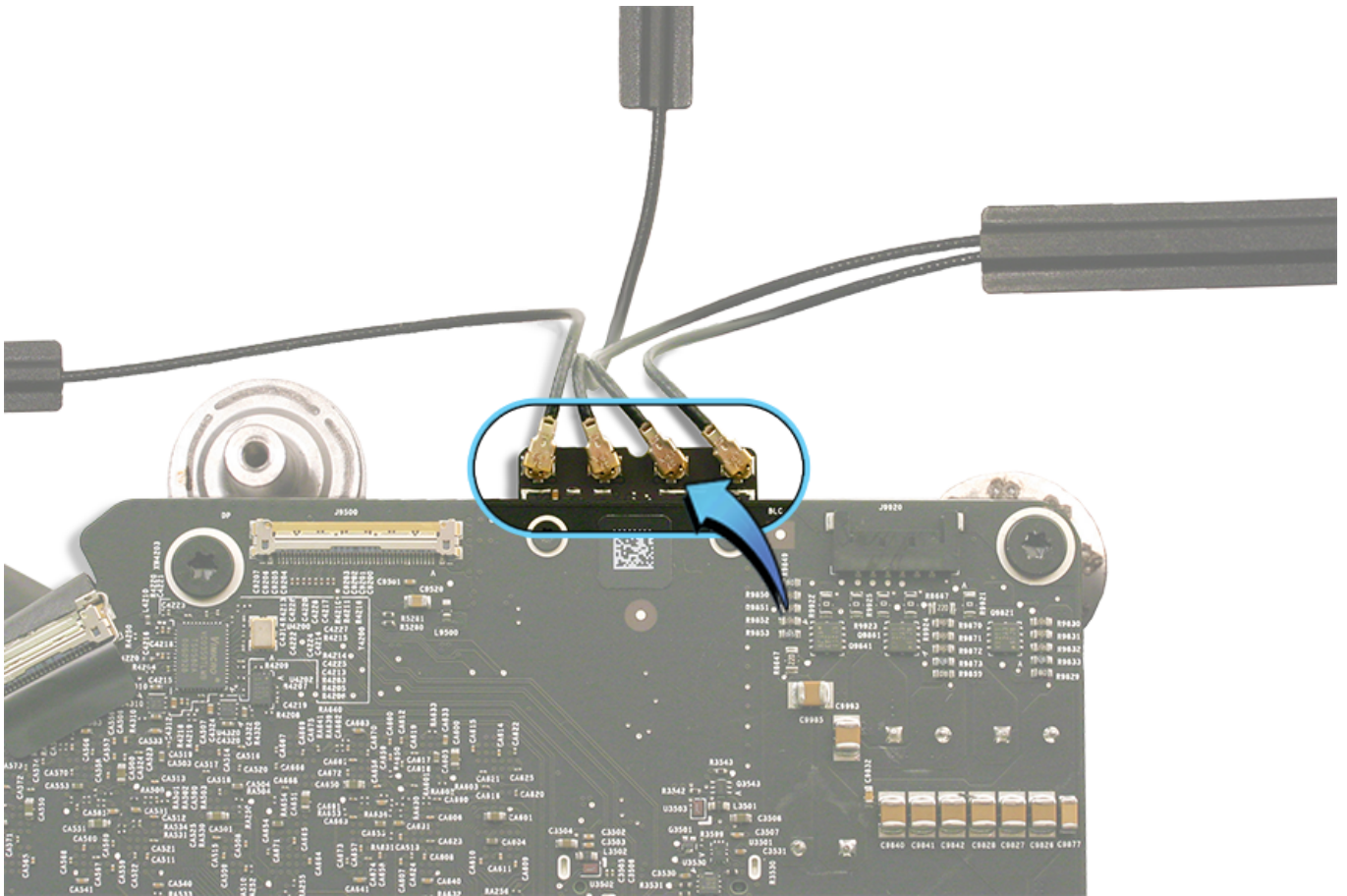
3. Connect the antenna to the second connector from the left on the wireless card.

**Note:** If installing a replacement antenna, peel the backing off of the Mylar tape and stick the antenna to the rear housing.

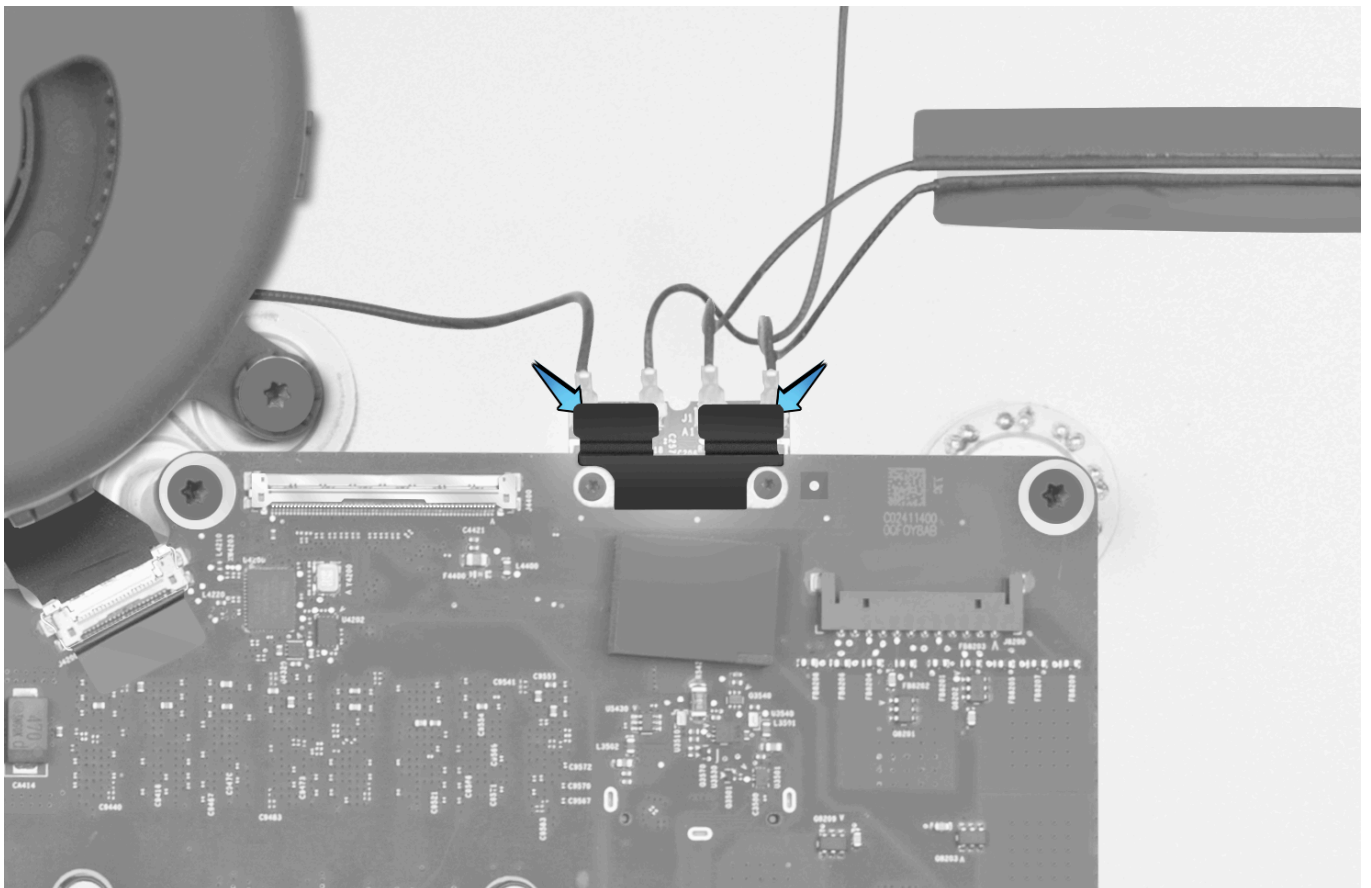
#### iMac (Retina 5K, 27-inch, Late 2014)



#### iMac (27-inch, Late 2012 and Late 2013)



4. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick or your finger to press the Mylar tape onto the antenna cable connectors.





# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Wi-Fi Antenna, Lower

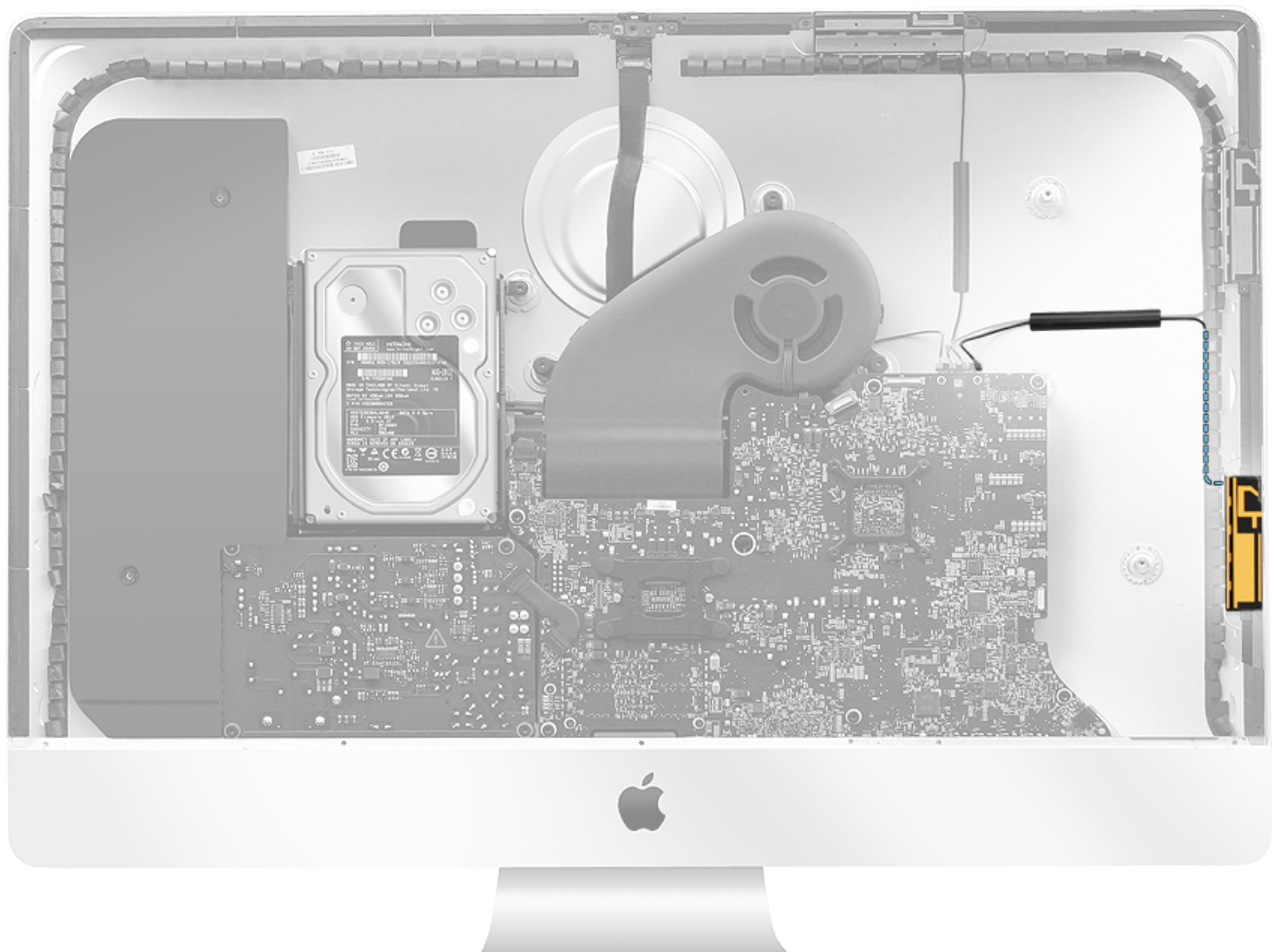
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

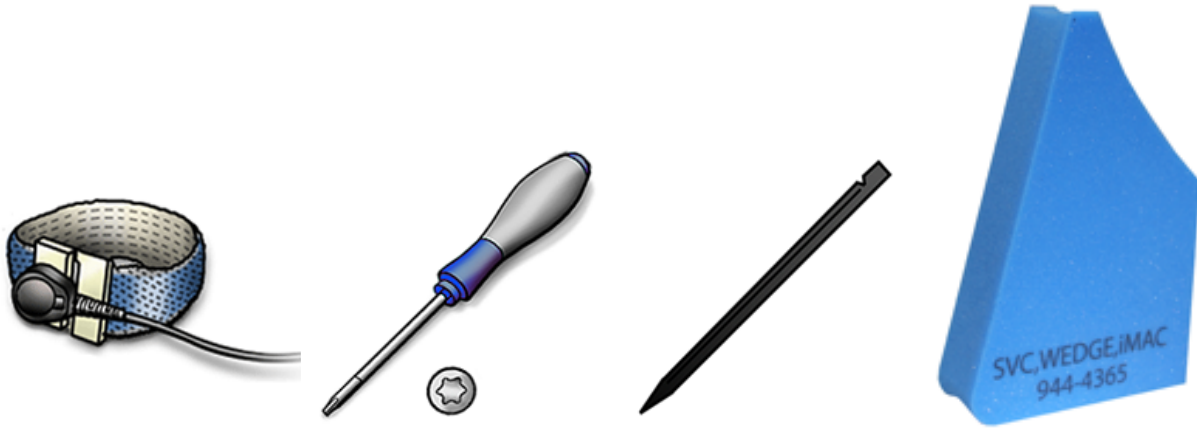
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Right speaker](#)



## Tools

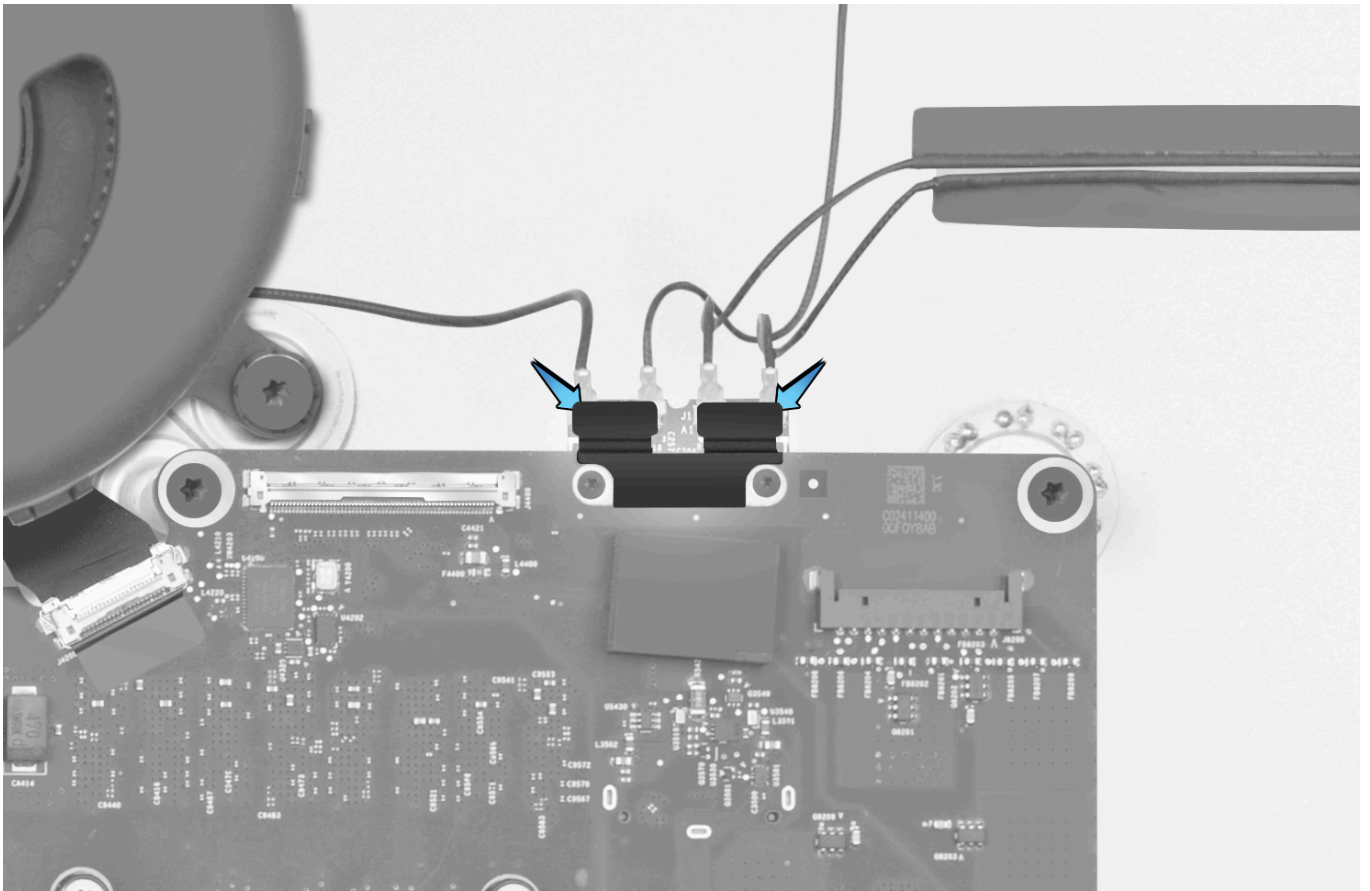
- ESD wrist strap and mat
- Torx T4 screwdriver (magnetized)
- Black stick
- Service wedge (iMac)



## Steps For Removal

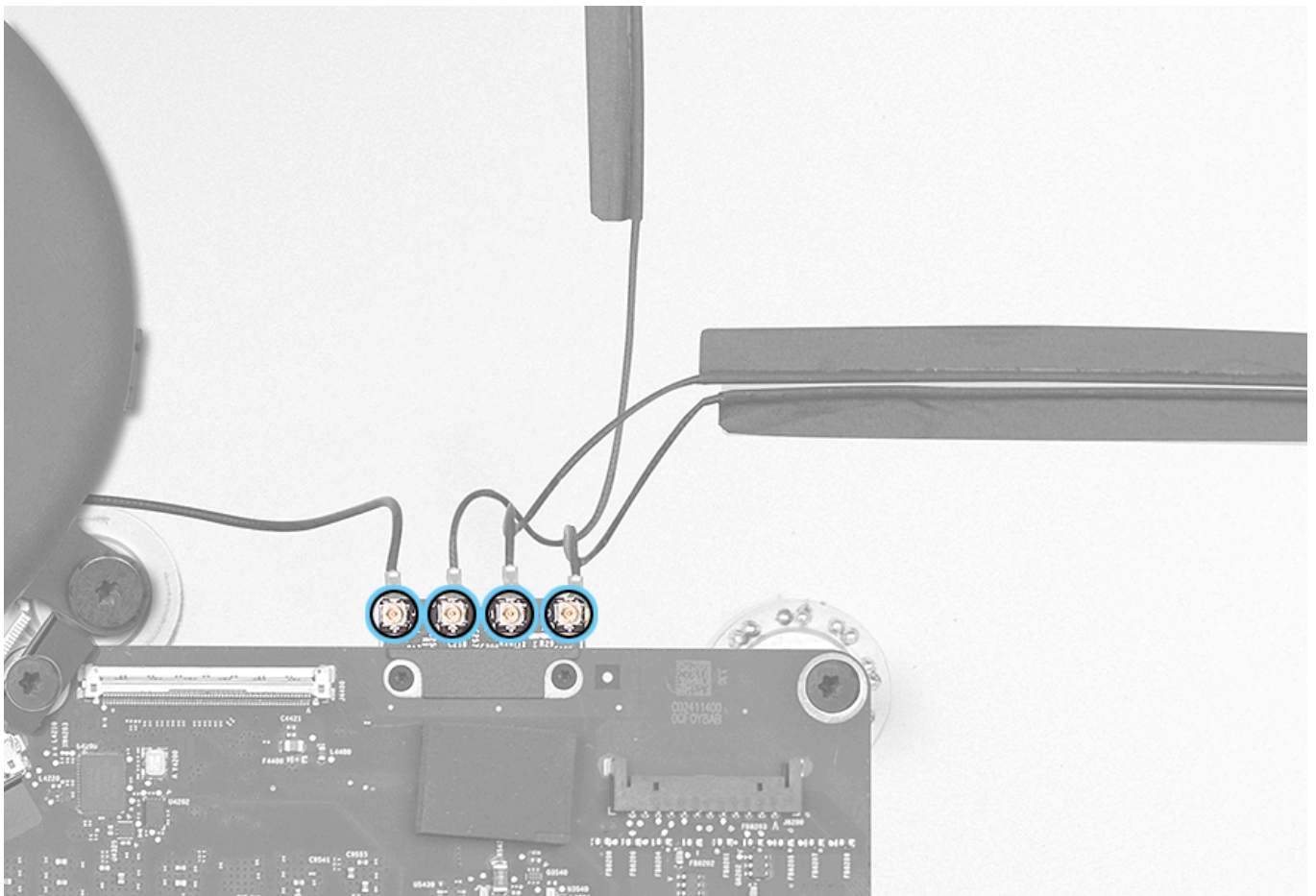
**Note:** The iMac has four (4) Wi-Fi/Bluetooth antennas, three (3) of which are removable. The fourth resides inside the Apple logo on the rear housing and can only be replaced by replacing the rear housing.

1. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick to peel down the tape that covers the antenna cable connectors.

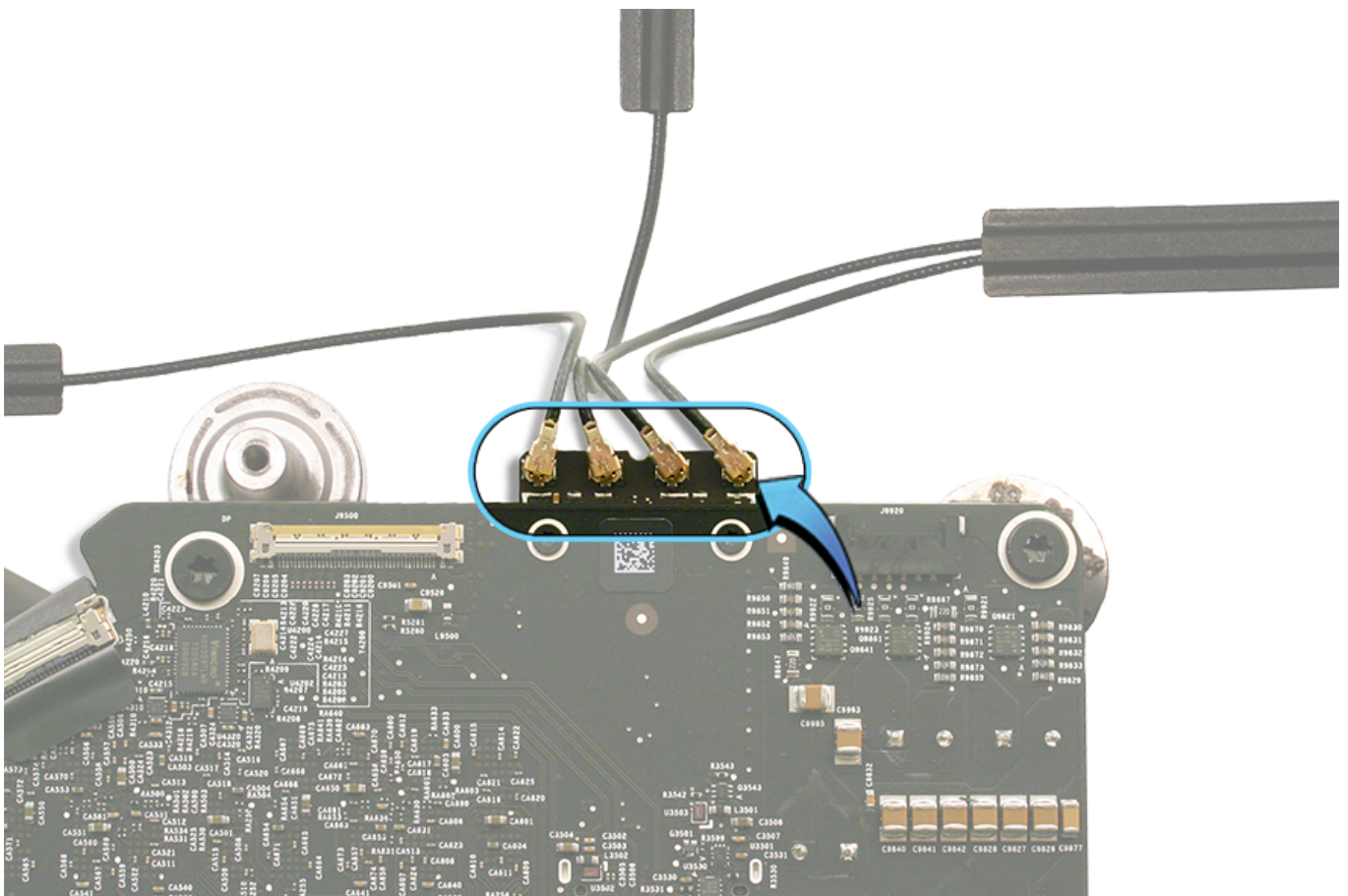


2. On the wireless card, disconnect the antenna on the far right.

**iMac (Retina 5K, 27-inch, Late 2014)**



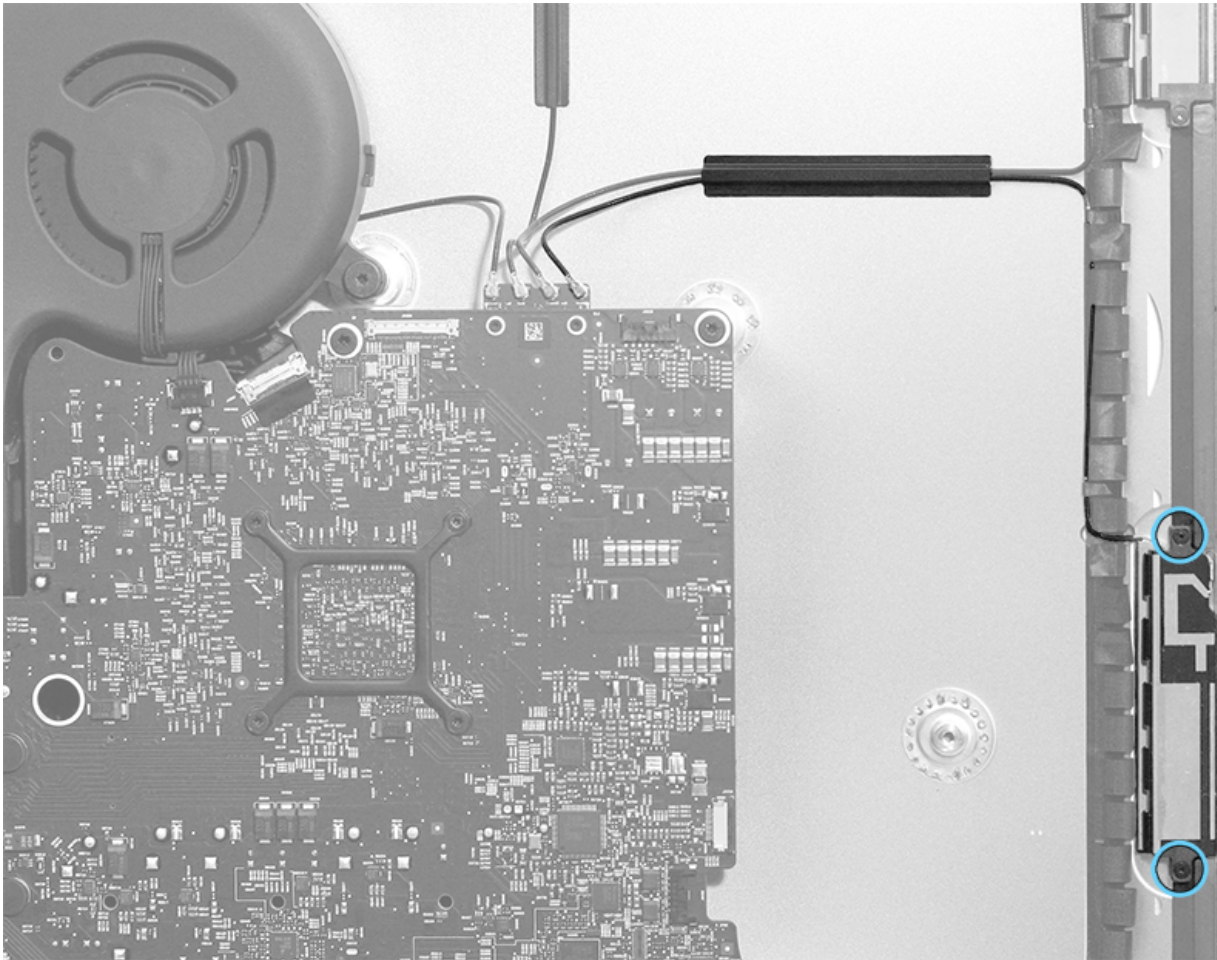
iMac (27-inch, Late 2012 and Late 2013)



3. Remove two (2) T4 antenna screws.

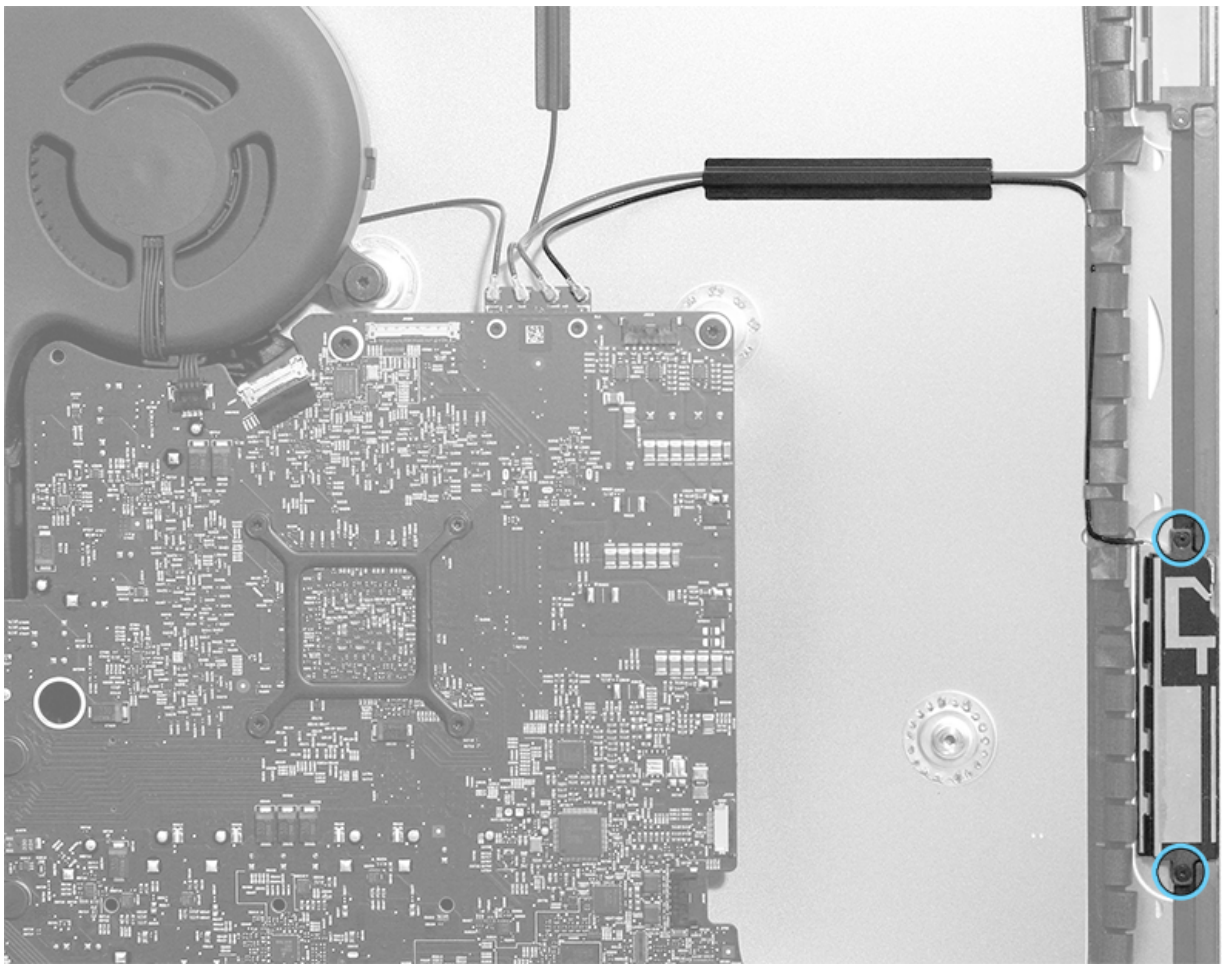
- 923-0304





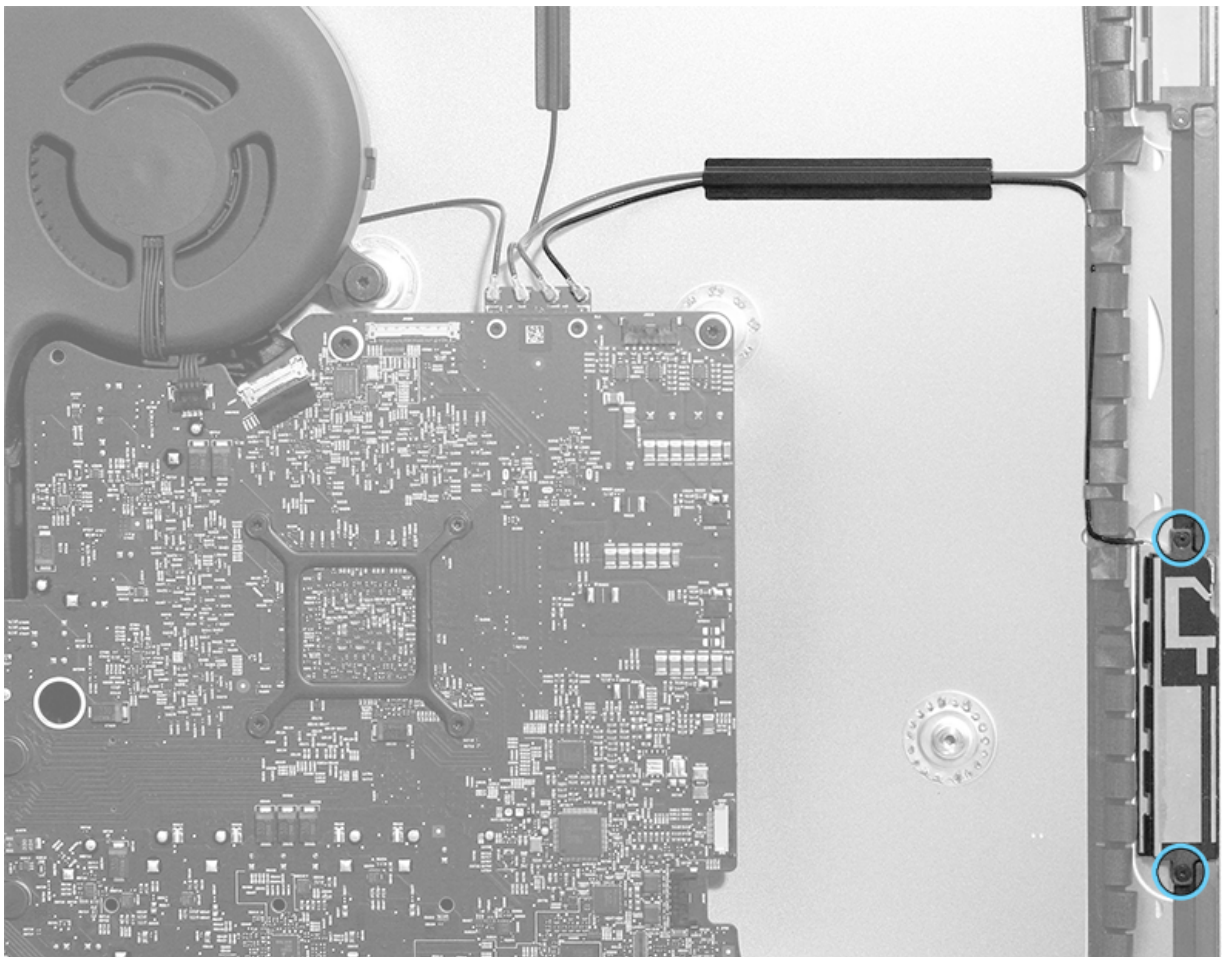
4. With a black stick:

- Peel up the tiny piece of Mylar tape that secures the antenna cable (located within the airloop gasket running alongside the antenna) to the rear housing.
- Pry up the insulator strip (iMac, Late 2012) or the black tape (iMac, Late 2013 or later) to free the antenna cable from the rear housing.



## Steps For Reassembly

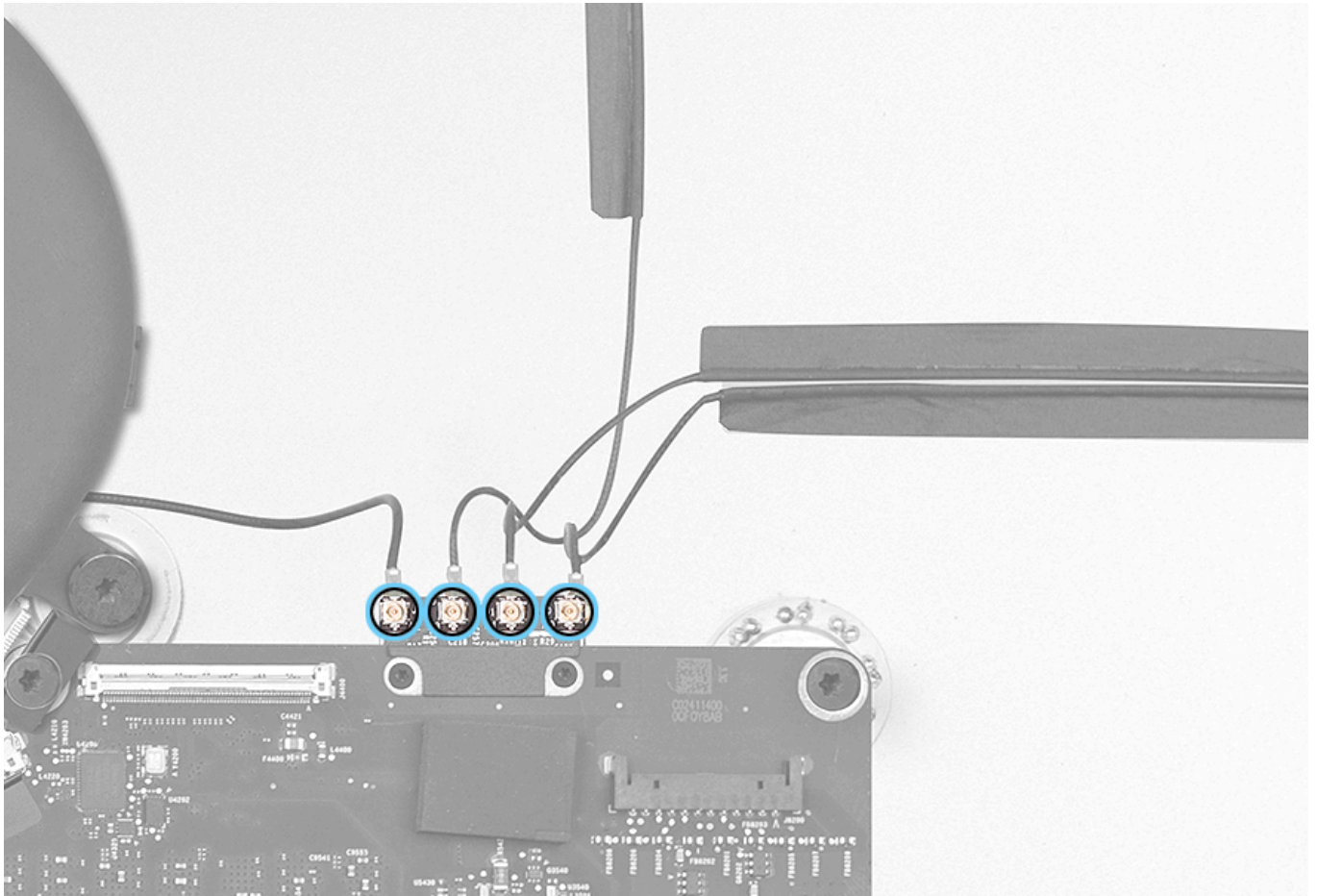
1. Install two (2) antenna screws to the Wi-Fi antenna.



2. Connect the lower antenna to the connector on the far right on the wireless card.

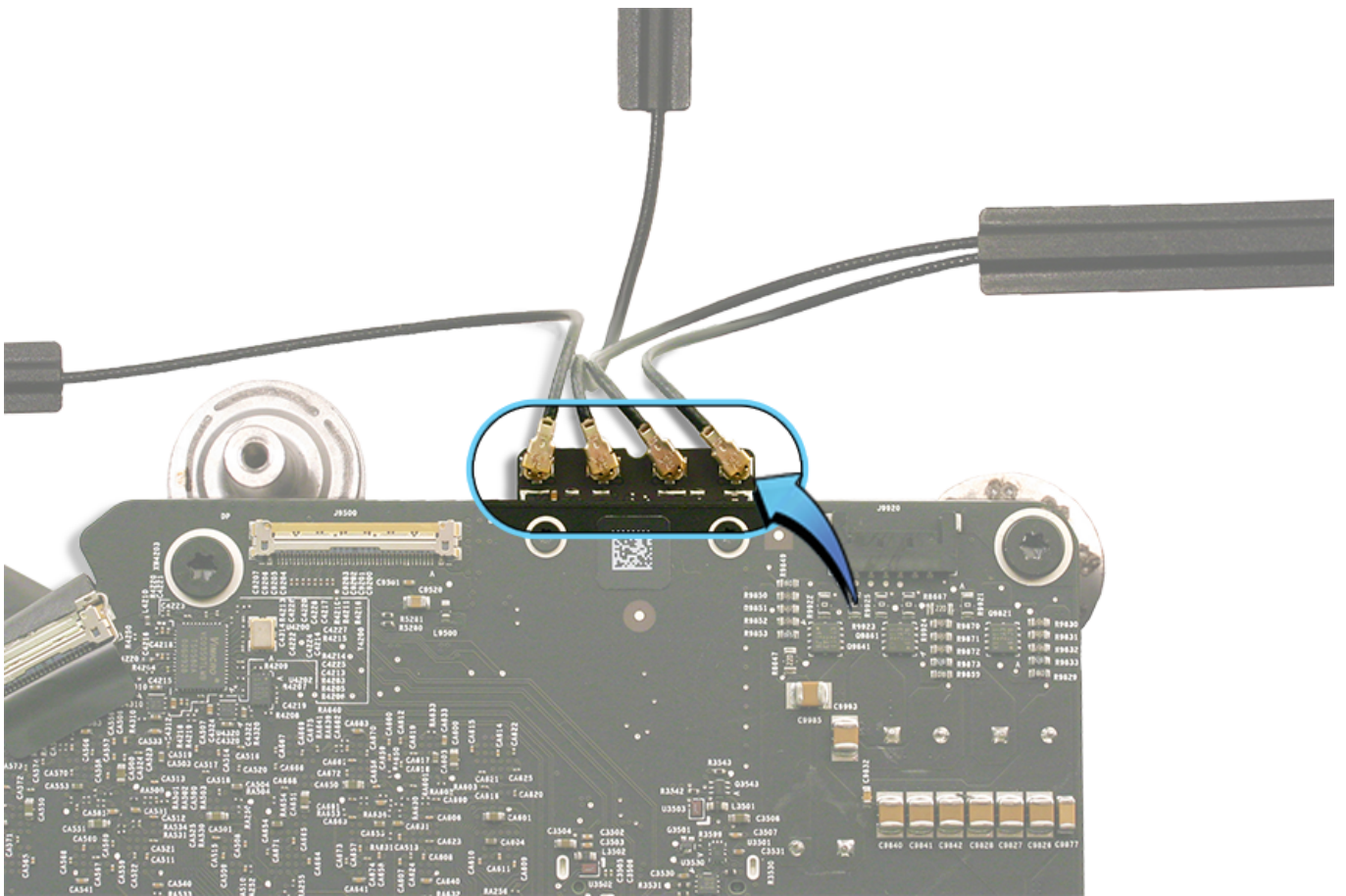
**Note:** If installing a replacement antenna, peel the backing off of the Mylar tape and stick the antenna to the rear housing.

#### iMac (Retina 5K, 27-inch, Late 2014)

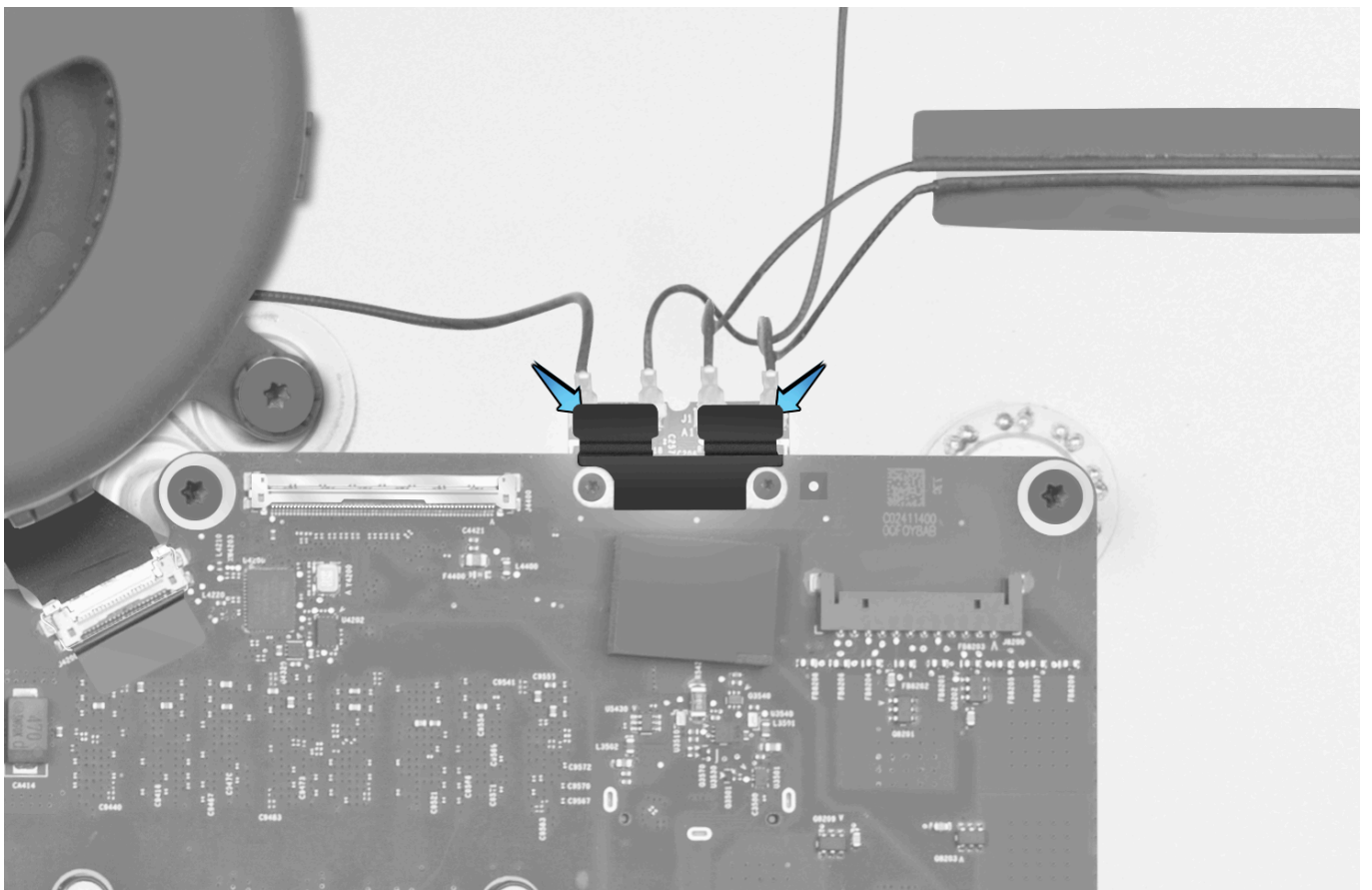


#### iMac (27-inch, Late 2012 and Late 2013)





3. For the iMac (Retina 5K, 27-inch, Late 2014), use a black stick or your finger to secure the Mylar tape onto the antenna cable connectors.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Power Supply

## First Steps

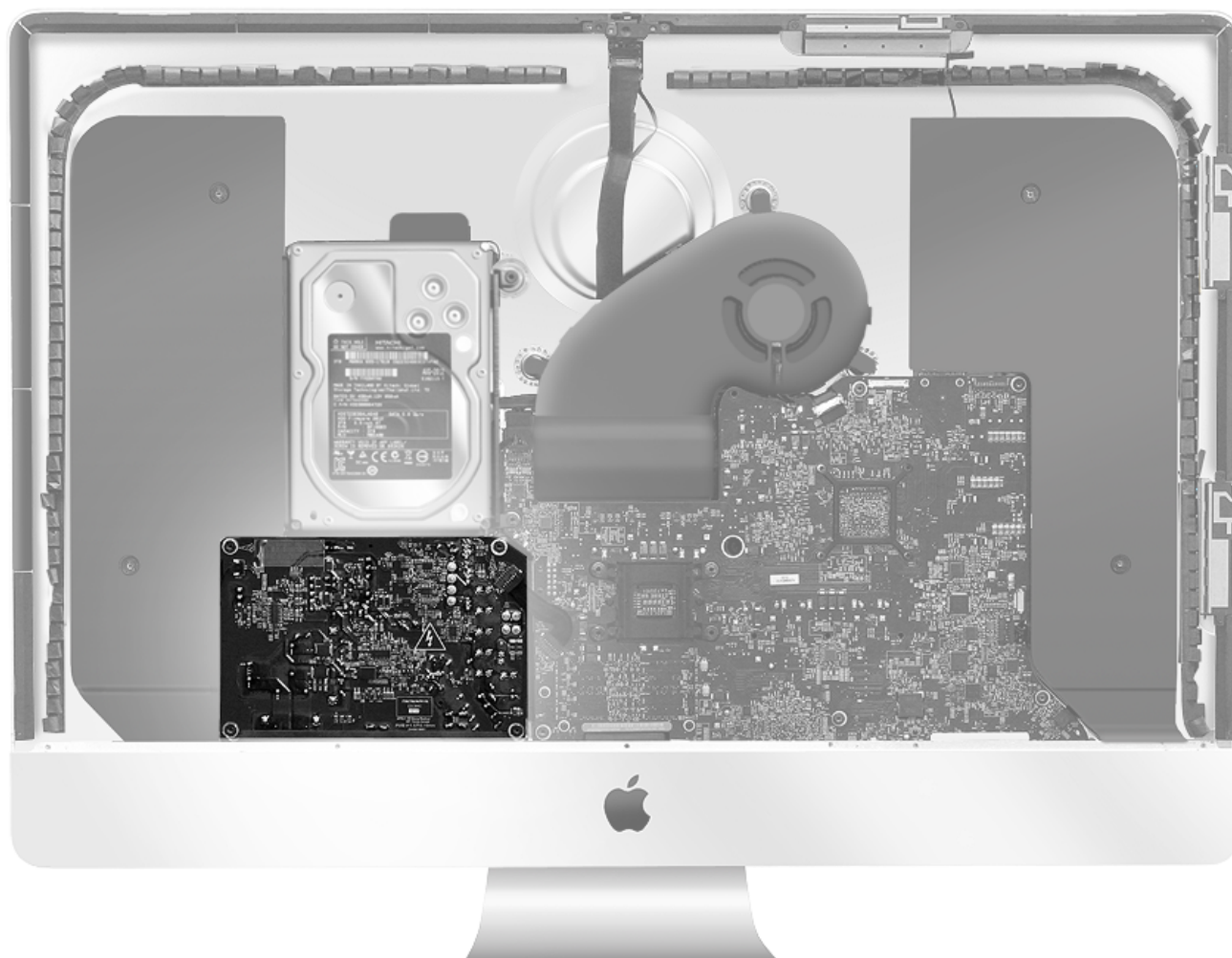
Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV246: Power Supply Replacement Video](#).

Before you begin:

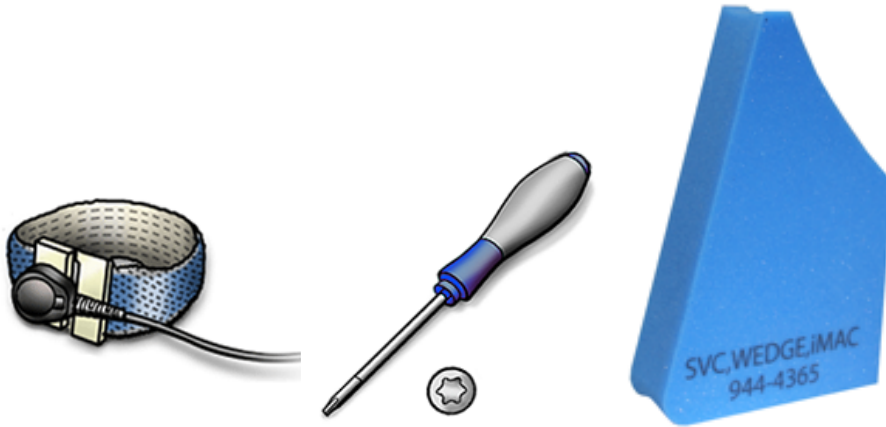
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Chin strap](#)
- [Left speaker](#)
- [Hard drive](#)



## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver (magnetized)
- Service wedge (iMac)



## Steps For Removal



**WARNING: High Voltage:** Use extreme caution when troubleshooting with the display panel removed. Avoid touching the logic board or power supply while the computer is plugged in, because the power supply retains a charge whether or not the computer is on. Before working on or near the power supply, unplug the power cord from the computer and wait at least two (2) minutes for the electricity to discharge.

- Never remove or install any physical components while the computer is plugged in to an electrical outlet.
- When plugged in, the power supply and logic board are energized, even when the computer is powered off.
- Unplug the computer and allow sufficient time for the power supply and logic board to self-discharge before removing the display panel.
- Do NOT touch the logic board or power supply while the computer is plugged in, or before sufficient time has passed to discharge the stored voltage to a safe level after being unplugged.

**WARNING:** After unplugging the computer from the electrical outlet, wait **two** minutes before removing the display panel, disconnecting modules, or substituting cables and components. This will allow the power supply and logic board time to discharge.

**iMac (Late 2012 and later) models require two protective covers (923-0189) when performing live adjustments: one for the power supply and one for the backlight control circuitry on the logic board. Secure the covers to the rear housing with tape, as shown in the following articles.**

- [TP833: iMac and Displays: Power Supply Cover Instructions](#)
- [TP820: iMac \(27-inch, Late 2012 and Late 2013\) and iMac \(Retina 5K, 27-inch, Late 2014\): Safety](#)

## Electrical Safety Precautions

Before working on a computer with exposed, potentially energized parts:

1. **Remove rings, watches, necklaces, metal-rimmed eyewear, and other metallic articles** which increase your risk of electric shock.
2. **Do not wear a cell phone or other signaling device**, as these may cause a dangerous startle reflex during energized work.
3. **If the iMac needs to be plugged in for LED checks or similar troubleshooting, do NOT wear an ESD wrist strap.** Wearing ESD grounding systems increases your risk of electric shock.
4. **Remain alert**, focused on the work being performed, and aware of the proximity of grounded objects to your body.
5. **Use the plastic black stick or other non-metal extension tool as needed** to connect or disconnect cables, to keep fingers away from potentially energized parts.

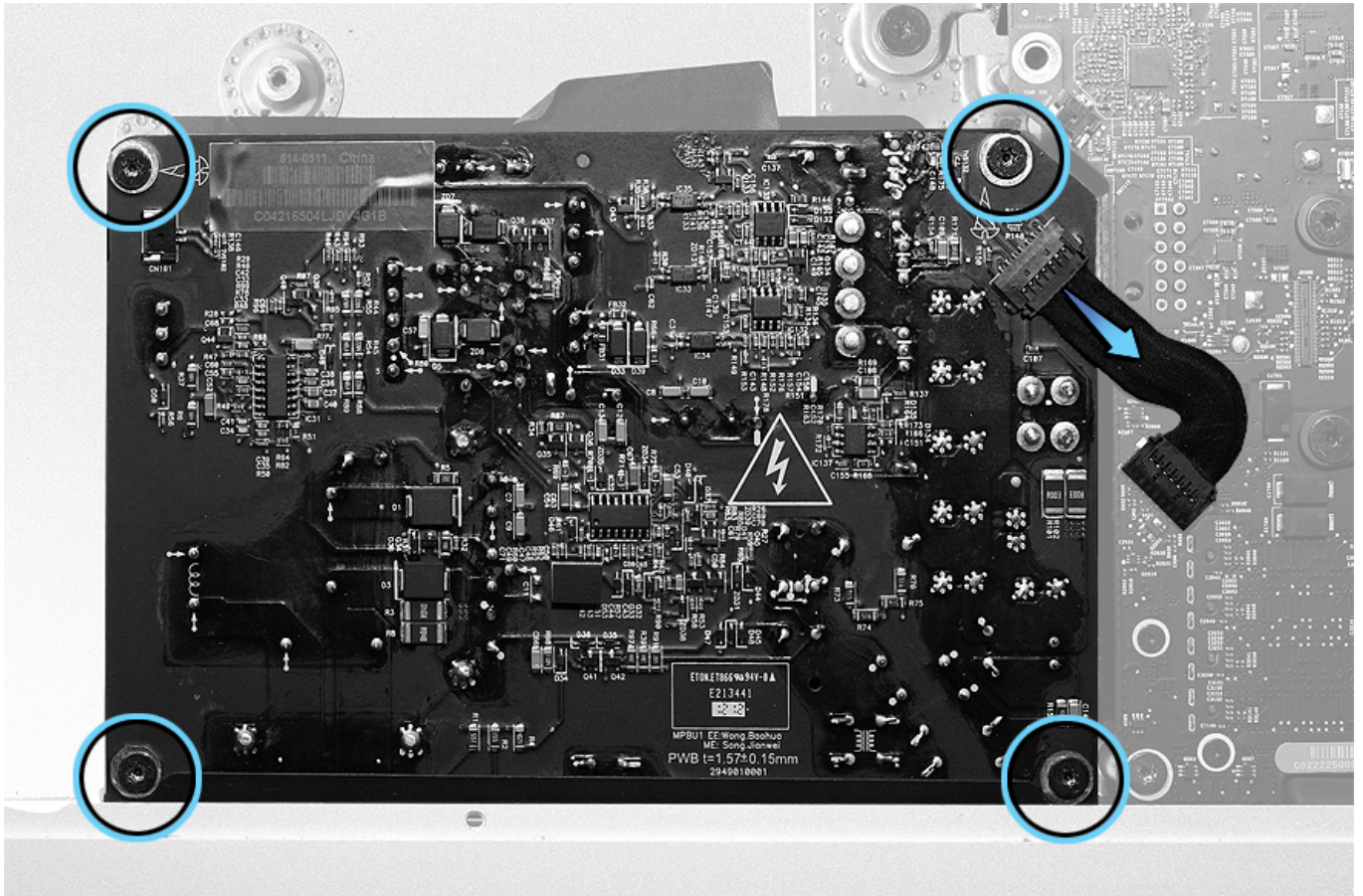
1. Disconnect the power signal cable from the power supply, then remove four (4) T10 screws.

- Two (2) 923-0396 (23 mm, along top edge)



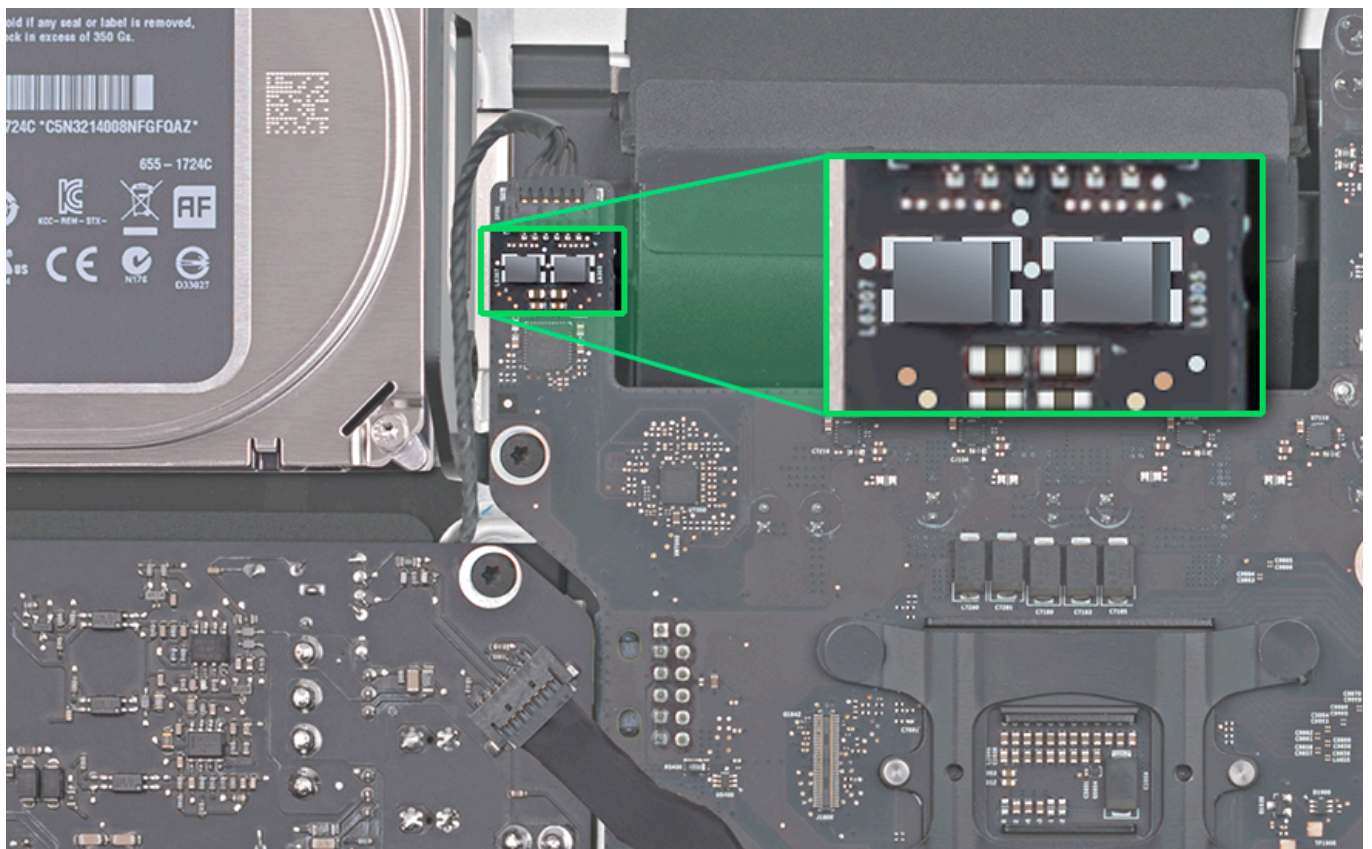


- Two (2) 923-0331 (7.05 mm, along bottom edge near chin)



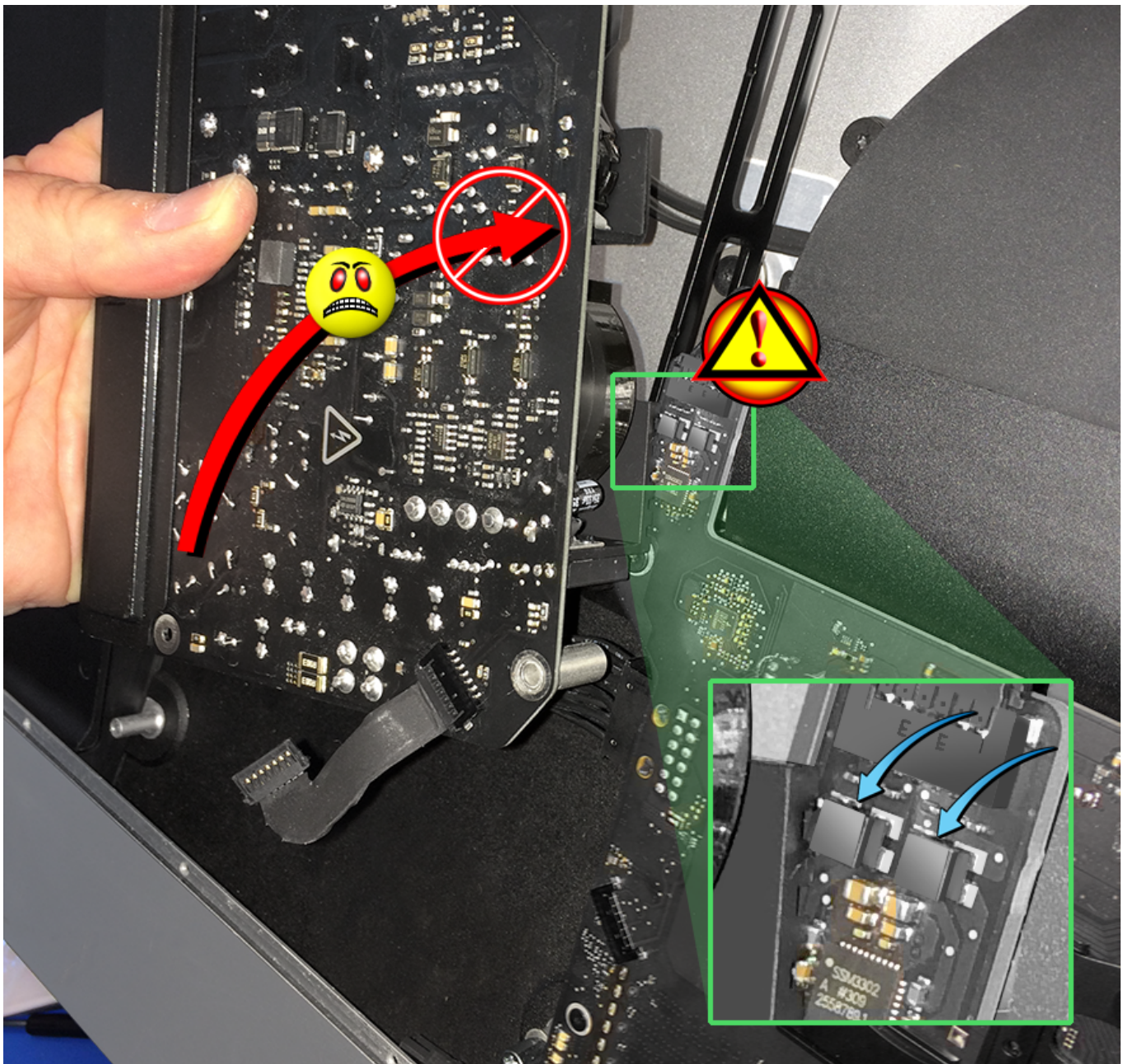
2. **Caution:** Do not rotate the power supply clockwise (toward the left speaker connector on the logic board) when attempting to disconnect the DC power cable from the logic board. The heat sink or other large components on the underside of the power supply could potentially make contact with two inductors on the logic board. If the inductors are damaged, the logic board will need to be replaced.

**iMac logic board inductors**



Do not rotate the power supply, as it could make contact with the inductors on the logic board. Remove the power supply as instructed in step 3.

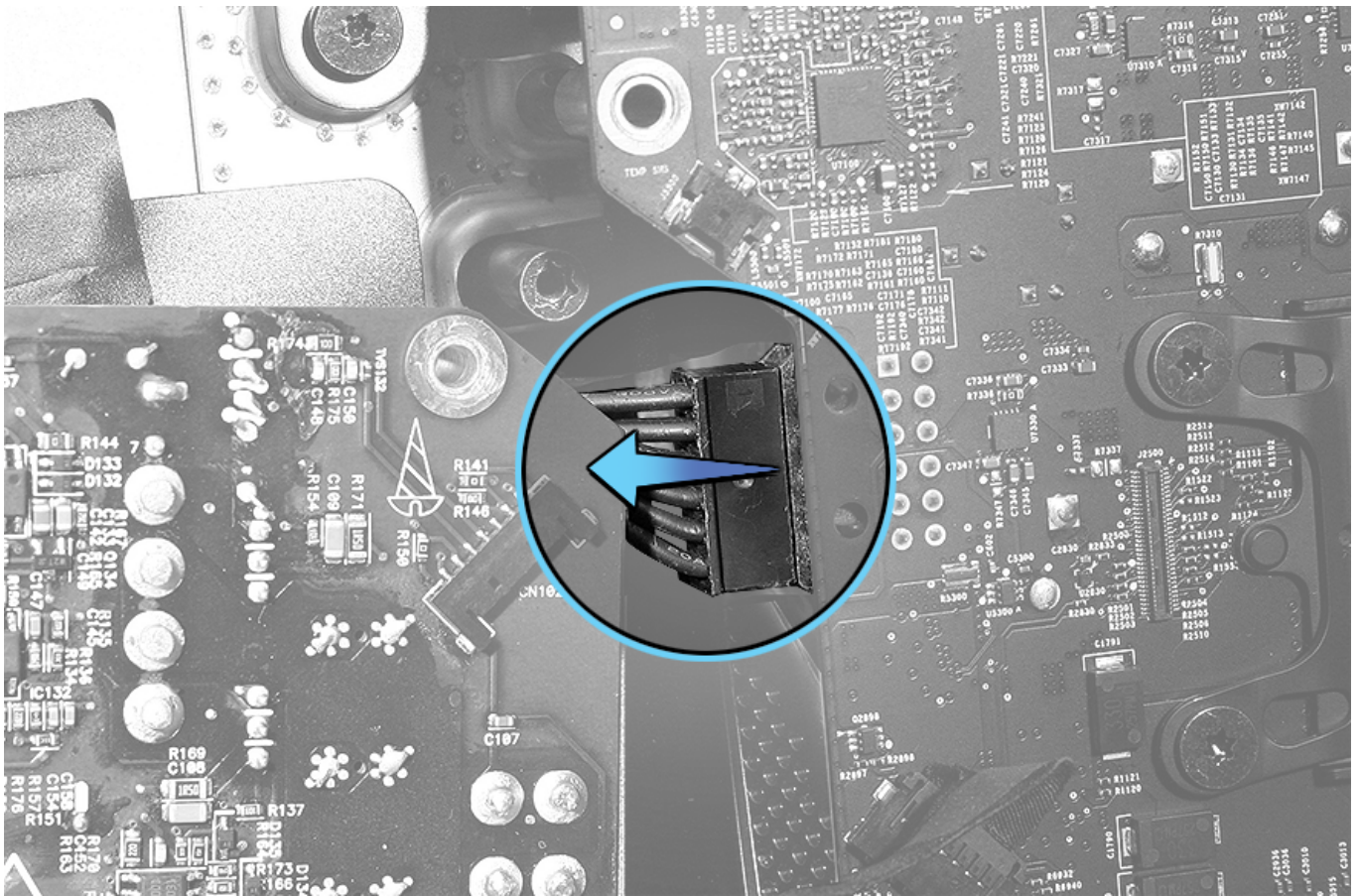




3. Slide the power supply slightly to the left. Reach underneath and disconnect the DC power cable. Pinch the cable connector to release and pull the cable toward the left speaker.

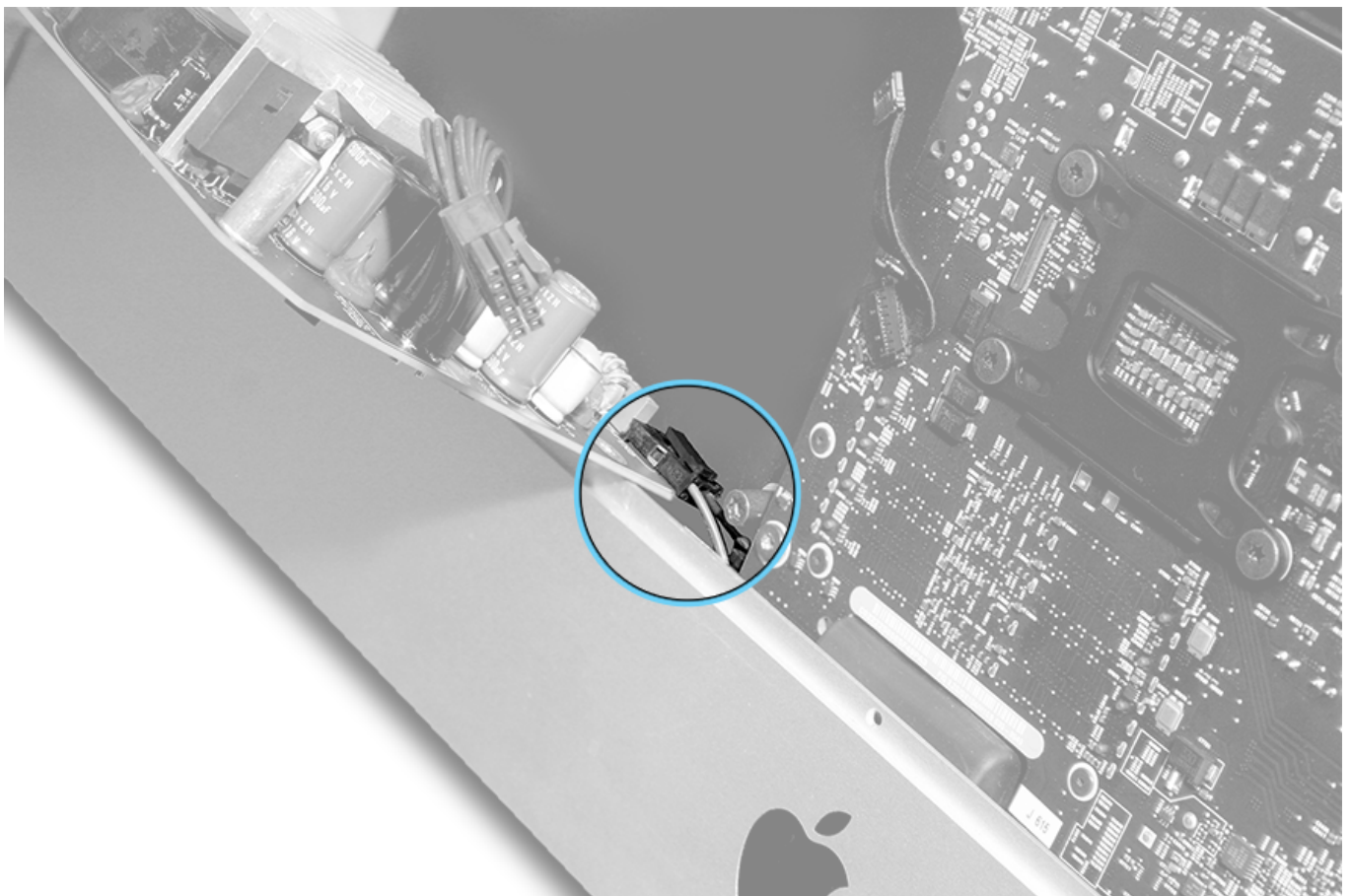
**Caution:** This is a tight connection. Pinch and pull **hard**. Use a black stick (on the underside of the power supply connector) to help release the latch on the connector.





4. Tilt the power supply slightly to disconnect the AC power cable. Pinch and pull the connector to the right.

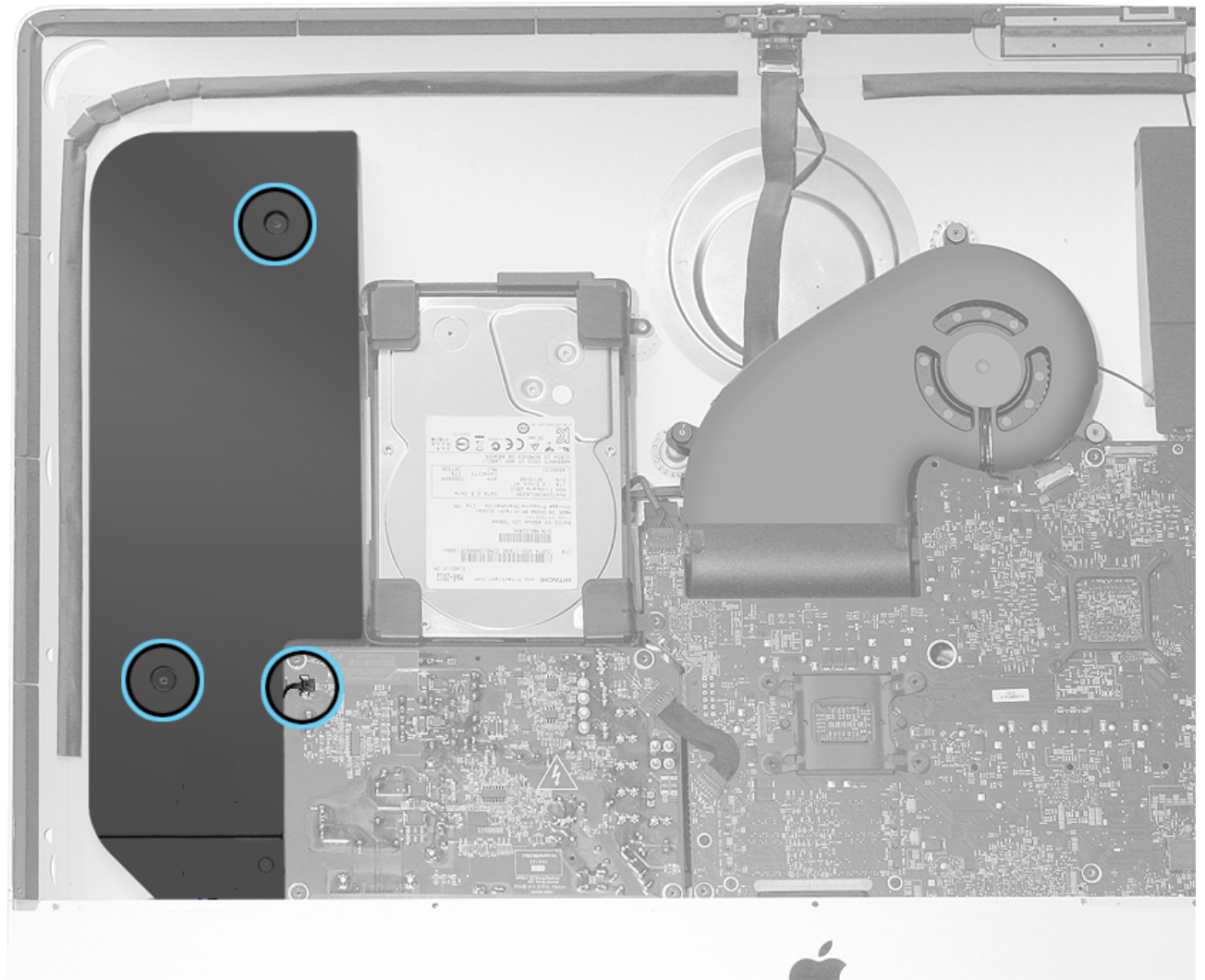
5. Lift the power supply out of the rear housing.



## Steps For Reassembly

1. Lower the power supply into the rear housing and connect the AC cable.
2. Connect the DC power cable to the logic board. Check that the cable is securely connected.

3. Reinstall four (4) power supply screws (replace the two (2) long screws at the top **first**, then the two (2) shorter screws at the bottom, near the chin.)
4. Connect the power signal cable to the power supply and logic board.
5. Install the hard drive.
6. Install the left speaker. **Note:** Don't forget to connect the power-on button cable to the power supply.



7. Install the display VHB strips.
8. Install the display panel.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Power Supply Signal Cable

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

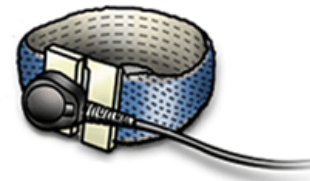
- [Display panel](#)
- [Display panel VHB strips](#)



## Tools

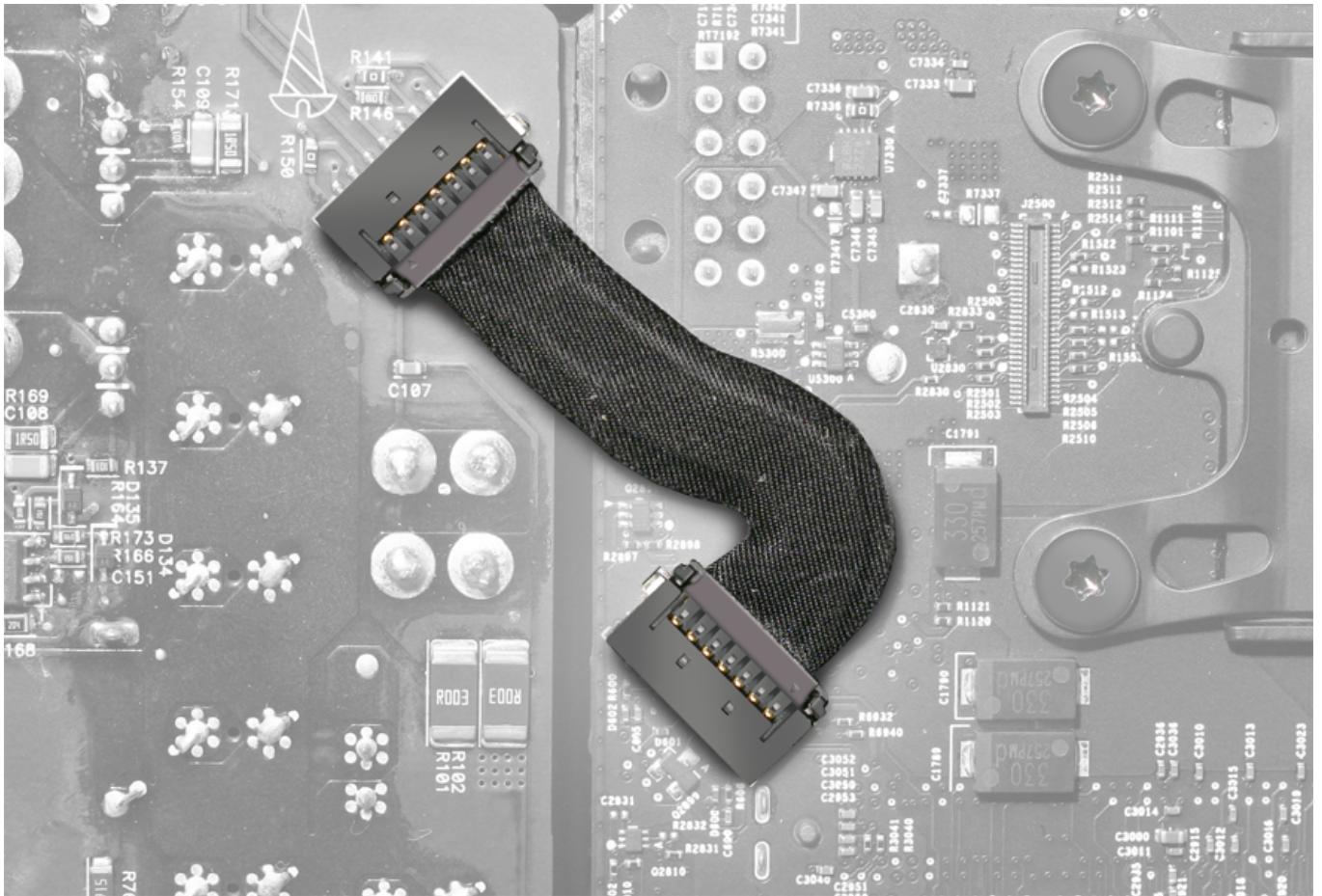
- ESD wrist strap and mat
- Service wedge (iMac)





## Steps For Removal

1. Disconnect the power supply signal cable from the power supply and the logic board.



## Steps For Reassembly

Reassemble in reverse order of removal steps.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Logic Board

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

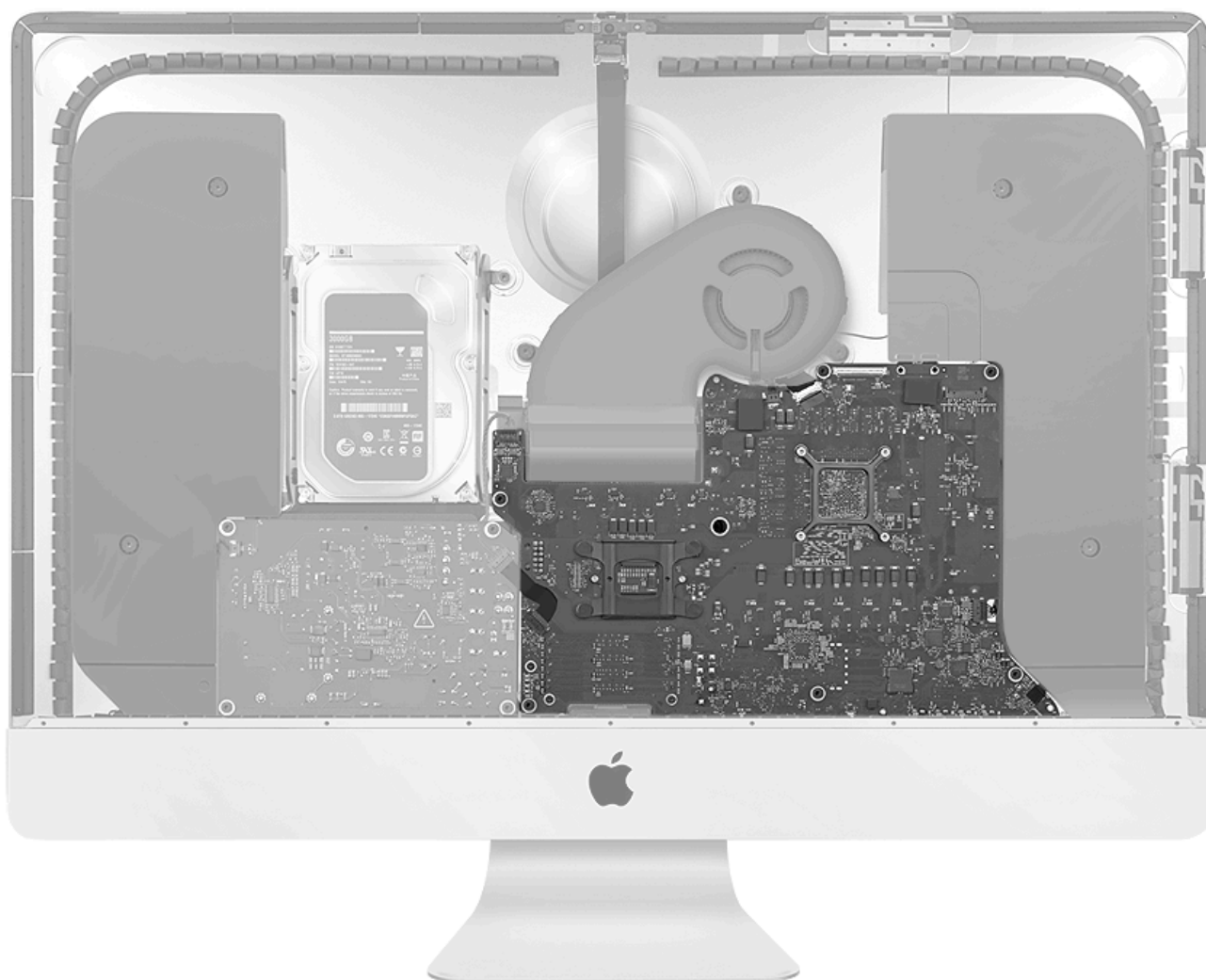
For video instruction, refer to Apple Support article [SV245: Logic Board Replacement Video](#).

Before you begin:

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)

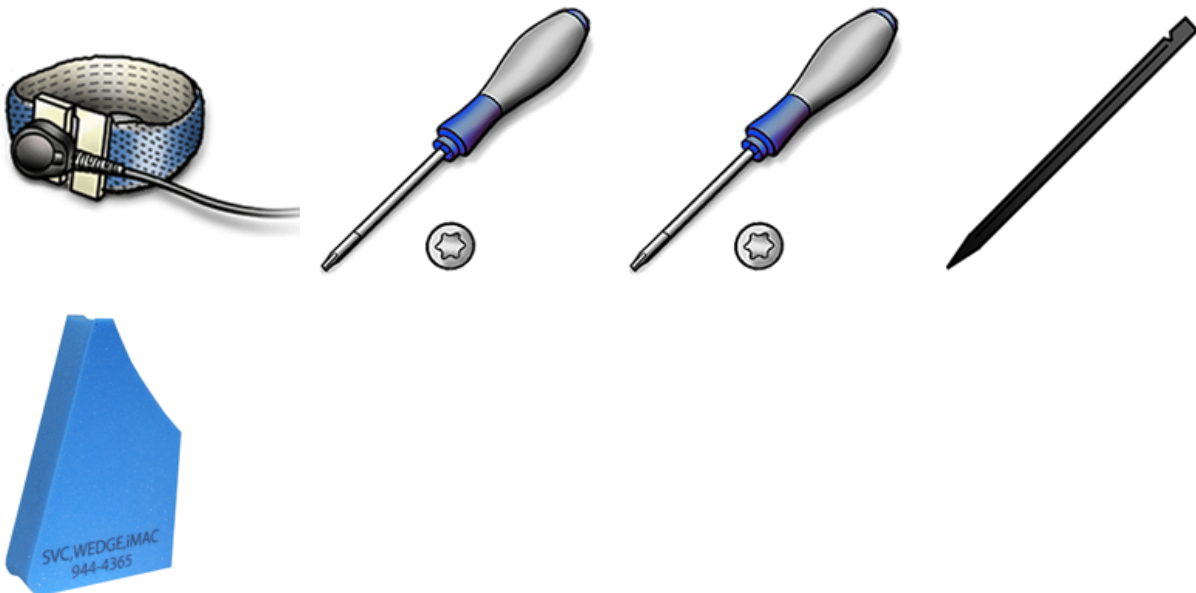
**iMac (Retina 5K, 27-inch, Late 2014)**



**iMac (27-inch, Late 2012 and Late 2013)**



## Tools



- ESD wrist strap and mat
- Torx T10 screwdriver
- Torx T25 screwdriver
- Service wedge (iMac)
- Black stick
- Two Mini DisplayPort or Thunderbolt cables and one USB cable for reassembly (not pictured)

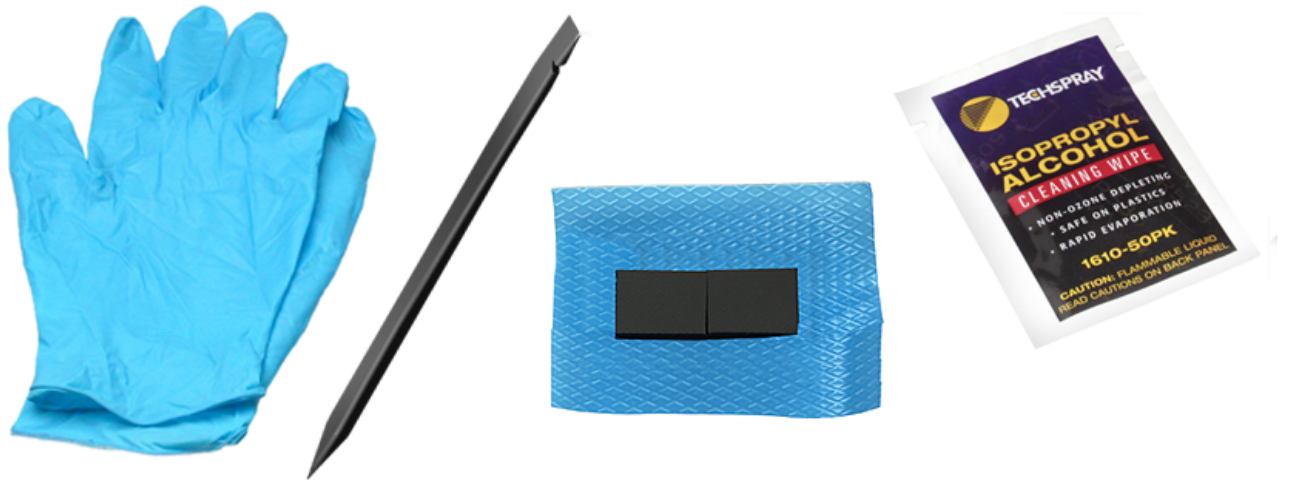
If removing or replacing the wireless card on the iMac (Late 2012 and Early 2013) model, you will also need the following tools:

- Nitrile gloves (use when cleaning twinpak thermal material)

- Black stick
- Thermal pad kit, 076-1445 (replaces the twinpak thermal material)
- Isopropyl alcohol (IPA) wipes

**Note:** On July 17, 2013, a thermal pad kit (076-1445) replaced the original twinpak of thermal material (076-1425) necessary for installing wireless cards in iMac (Late 2012 and Early 2013) models. The thermal pad kit is included with the wireless card and logic board replacement parts on the iMac (Late 2012 and Early 2013) models. On the iMac (Late 2013 and later) models, the thermal pad is included with the just the wireless card. The thermal pad kit is also available separately (076-1445).

Whenever you remove or replace the wireless card in an iMac (Late 2012 and Early 2013) model, check for a dollop of original thermal material. If it is present, remove the original thermal material, clean with an IPA wipe, and install one thermal pad to the wireless card.

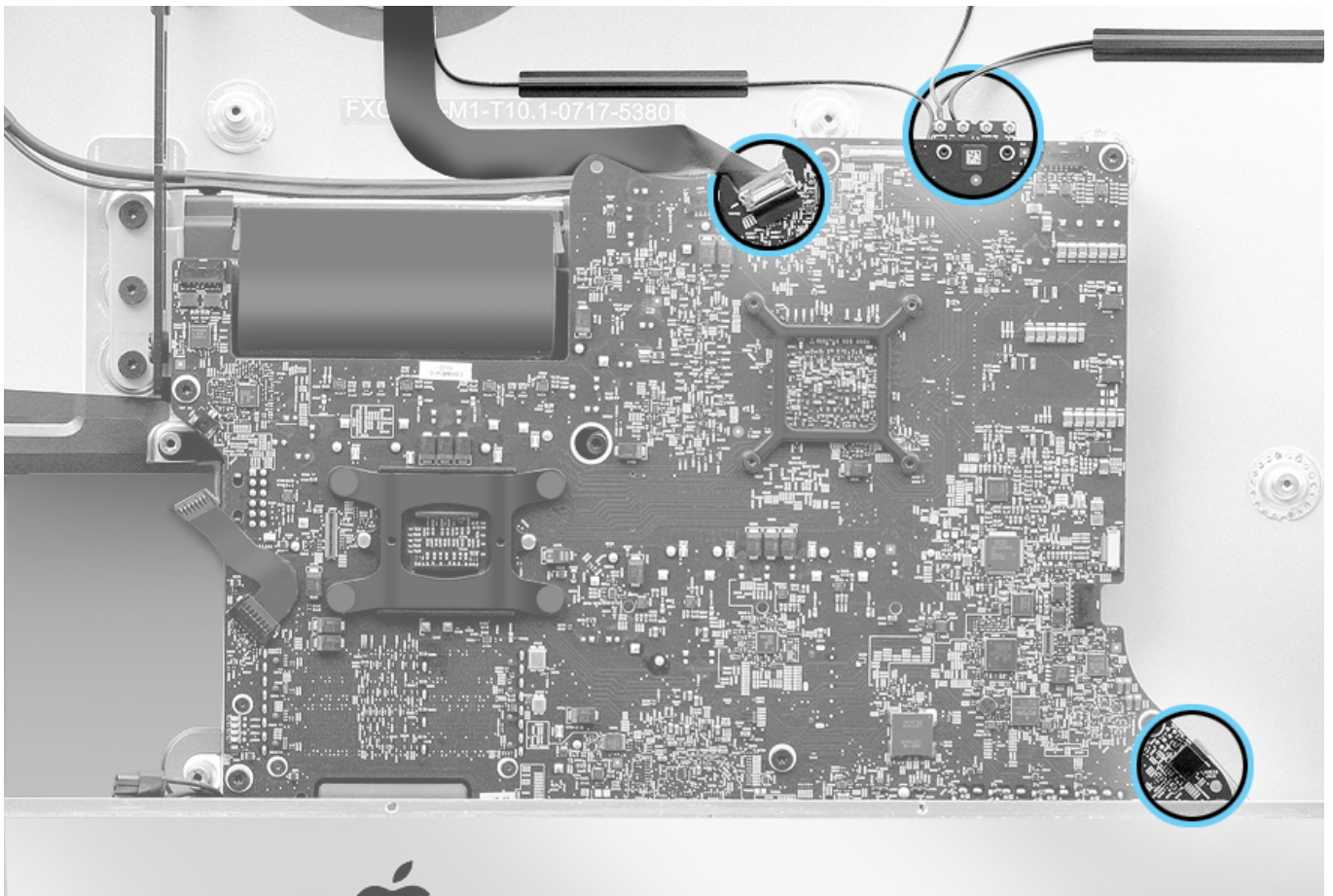


## Steps For Removal

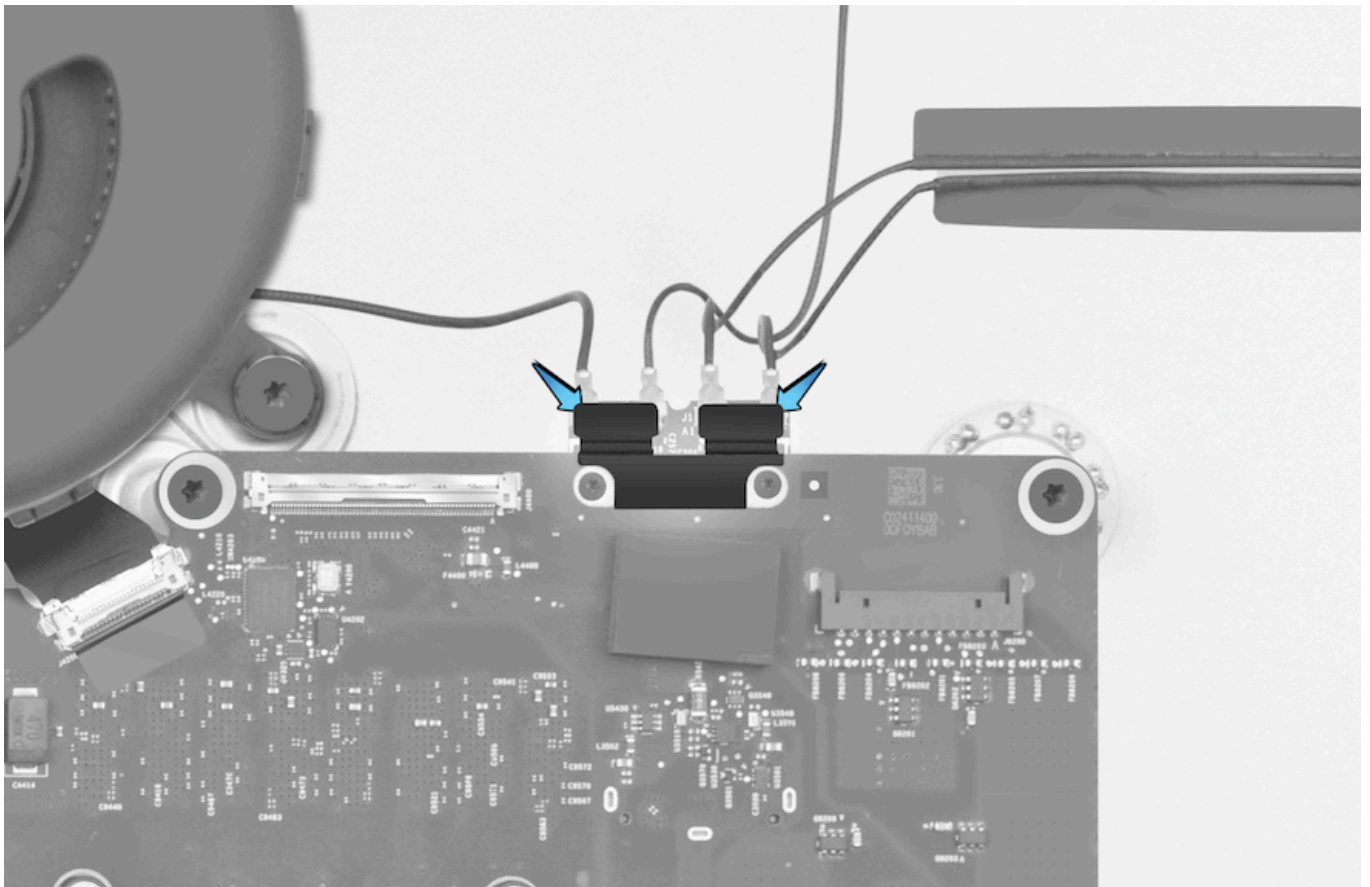
1. Carefully disconnect the following from the logic board:

- Camera/microphone locking-lever bar (flip the bar toward the cable)
- Antennas from the wireless card
- Audio connector (lower right corner of the logic board)





**Note:** iMac (Retina 5K, 27-inch, Late 2014) has Mylar tape securing the antenna connectors to the wireless card. Use a black stick to peel the tape forward to access the antenna connectors.



2. Remove eight (8) T10 screws and one (1) T25 standoff, and completely unscrew one (1) captive screw in the center of the board.

Screw legend:

- S = short screw x 4
  - 923-0331, four (4) short



- SS = short shoulder screw x 2
  - 923-0395, two (2) short shoulder



- L = long screw x 2
  - 923-0396, two (2) 23mm, long



- \* = T25 standoff x 1 (black, in iMac, Late 2012)
  - 923-0373 one (1) T25, PSU standoff

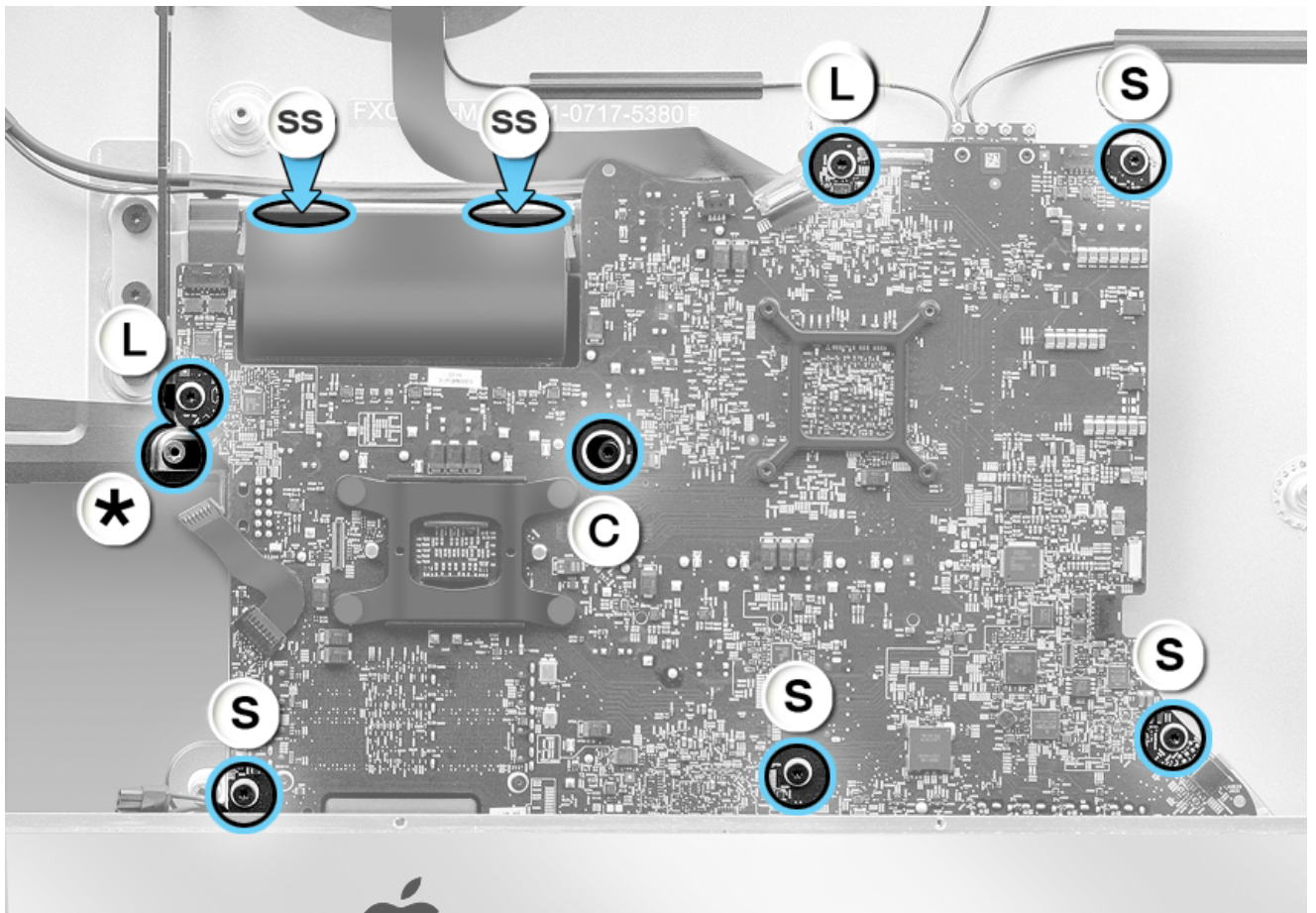


- \* = T25 standoff x 1 with shorter thread
  - 923-0520 one (1) T25, PSU standoff



- C = captive screw x 1 (located in the middle of the board, image not shown) **Note:** The captive screw is not available separately.





3. Carefully tilt the board forward. Disconnect the hard drive data (upper connector) and power cable (lower connector) from the two connectors on the back of the logic board. Pull the data cable connector toward the rear housing. Pinch the clip on the power cable connector and pull toward the rear housing.



4. With two hands, carefully lift the logic board from the rear housing. **Caution:** Handling the logic board incorrectly can damage chips and circuits. Be extremely careful when removing and replacing the logic board. Components that contact the enclosure, standoffs or other modules may cause damage and prevent the iMac from operating correctly.

## Handling the Logic Board

- Always handle the logic board by its edges.
- Never handle the logic board by the heat sink.

5. Verify that the tamper indicator labels on the heat sink are intact. If labels have been removed or tampered with, the logic board is not eligible for exchange.

## Steps For Reassembly

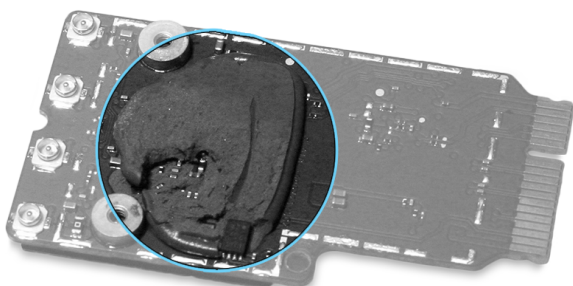
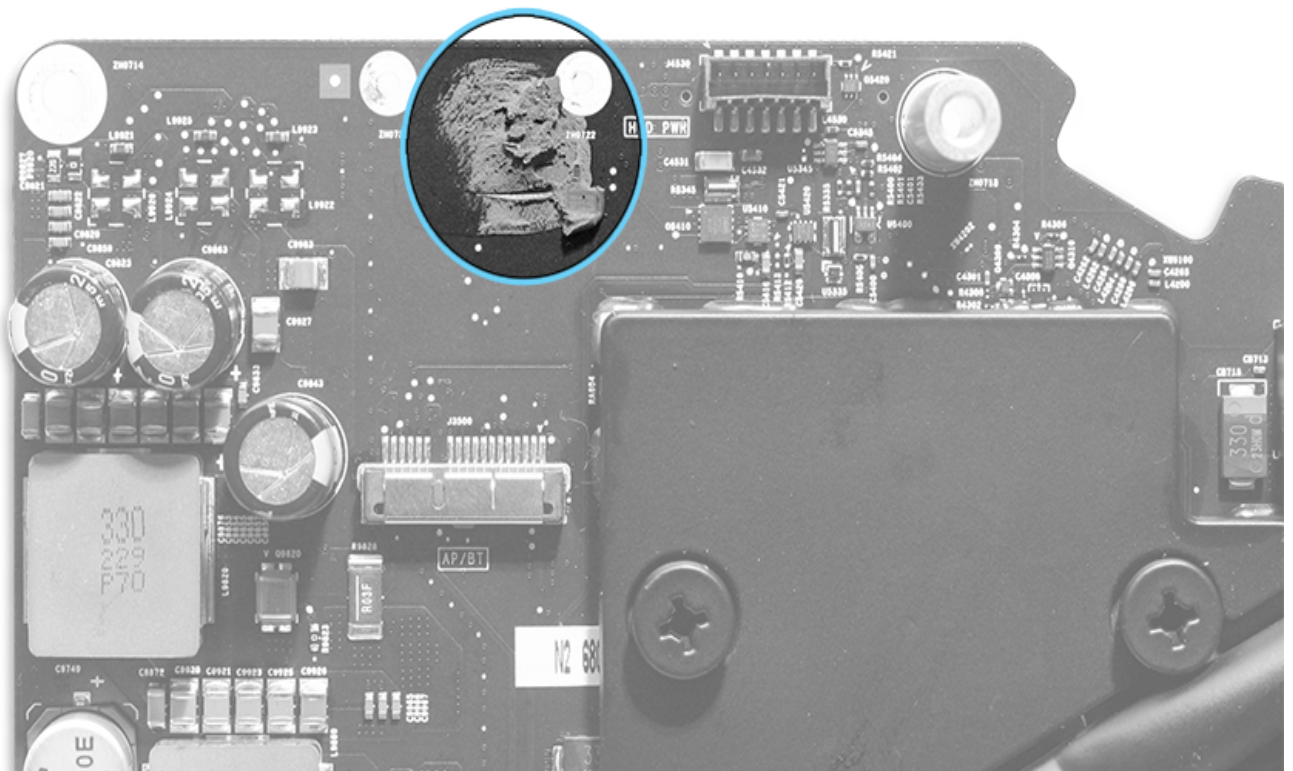
1. If installing a replacement logic board, transfer these parts from the old logic board:

- hard drive data and power cable
- memory
- power supply signal cable (short black cable that connects to the power supply and logic board)
- wireless card (apply thermal pad before installing)
- flash storage (if present) for Fusion Drive configurations

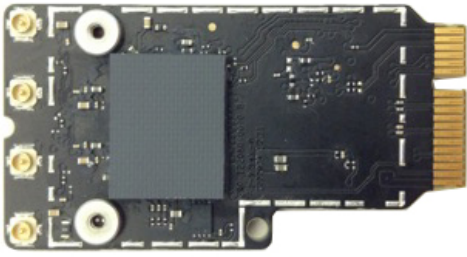
2. If thermal material is present on a Late 2012 model, use a black stick to **carefully** remove the original thermal material, clean with an IPA wipe, and install one thermal pad to the wireless card. The iMac (Late 2013) models are manufactured with a thermal pad. On the Late 2013 models, transfer the pad to the wireless card. If the pad is damaged, install a new pad.

**Note:** The thermal pad kit is included with the wireless card replacement part **only** for the iMac (Late 2013) models. Refer to Apple Support article [RP966: Wireless Card](#).

## Logic board and wireless card with thermal material



## Wireless card with thermal pad



3. Insert the logic board into the rear housing. **Caution:** Handling the logic board incorrectly can damage chips and circuits. Be extremely careful when removing and replacing the logic board. Components that contact the enclosure, standoffs or other modules may cause damage and prevent the iMac from operating correctly.

4. Connect the hard drive data and power cable to the back of the logic board.

5. Align the connectors with the ports and install the logic board screws, **but do not tighten the screws at this point.**

Screw legend:

- S = short screw x 4
  - 923-0331, four (4) short



- SS = short shoulder screw x 2
  - 923-0395, two (2) short shoulder



- L = long screw x 2
  - 923-0396 two (2) 23mm, long



- \* = T25 standoff x 1 (black, in iMac, Late 2012)
  - 923-0373 one (1) T25, PSU standoff



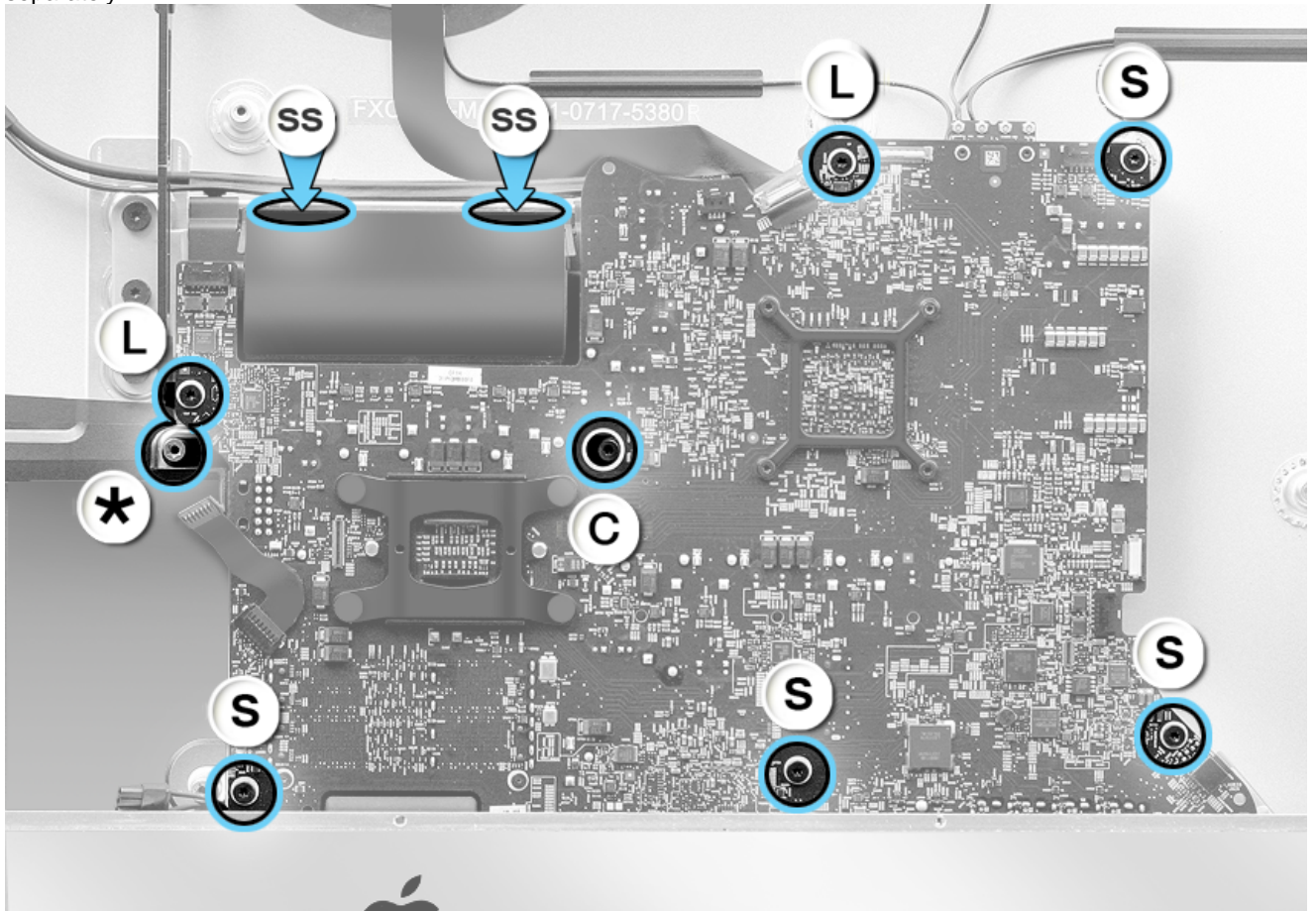
- \* = T25 standoff x 1 with shorter thread
  - 923-0520 one (1) T25, PSU standoff



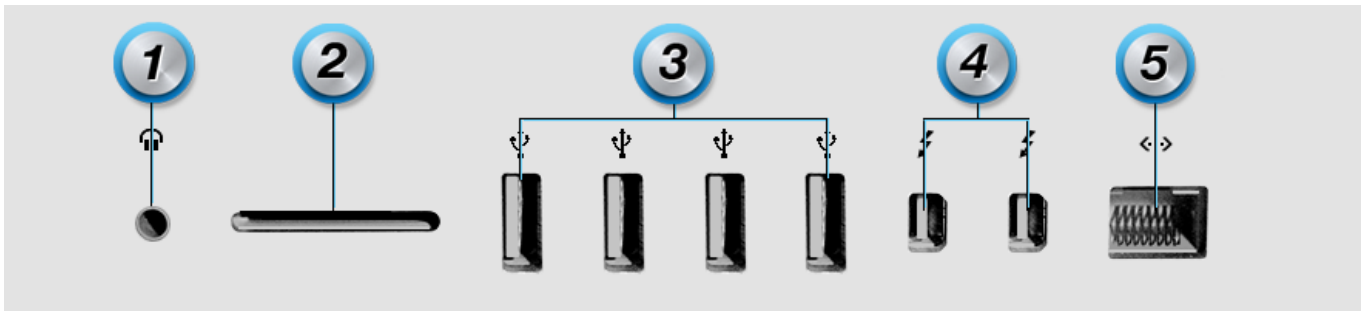
- C = captive screw x 1 (located in the middle of the board, image not shown) **Note:** The captive screw is not available



separately.



6. To ensure correct logic board alignment with the rear housing, plug in one (1) USB cable (#3) and two (2) Thunderbolt cables (#4) while tightening the logic board screws.



7. Connect the camera/microphone cable, wireless antennas, and audio cable.

8. Apply the new Ethernet ID label (included in the box with the replacement logic board) to the bottom of the stand.

9. Use [Blank Board Serializer](#) to set the computer's serial number on the replacement logic board.

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Solid State Drive (SSD) Card or Flash Storage

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

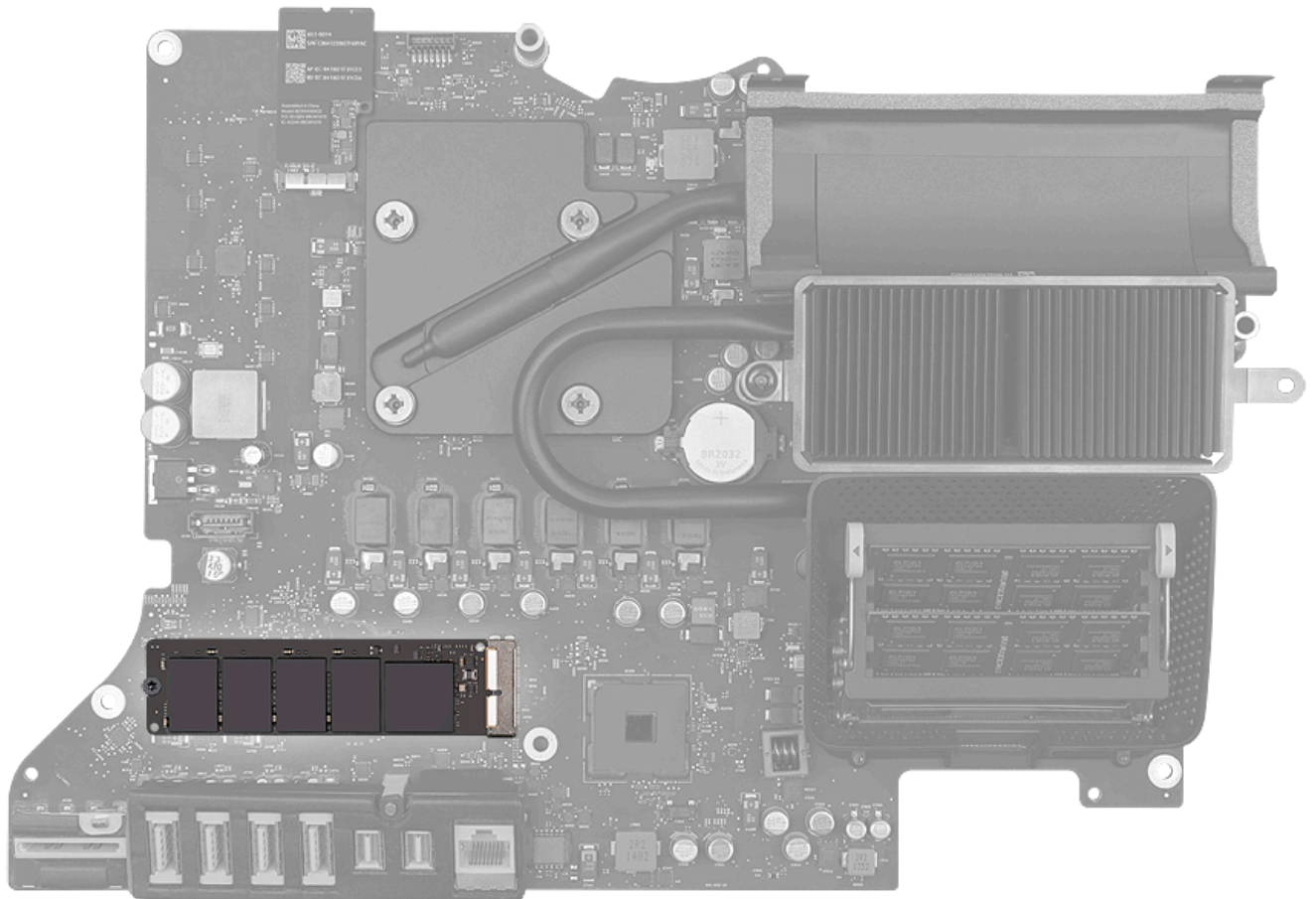
For video instruction, refer to Apple Support article [SV248: Flash Storage Replacement Video](#).

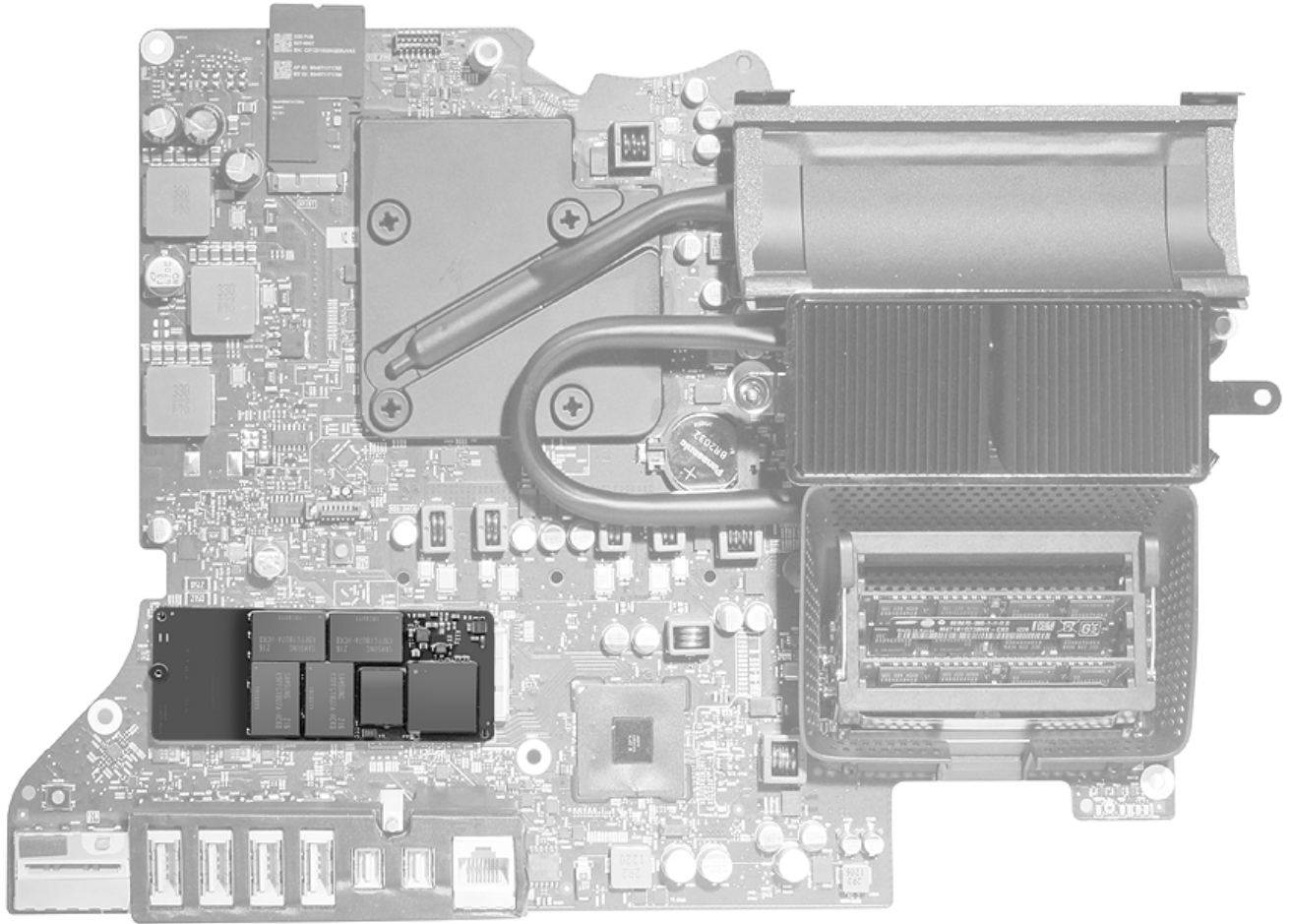
Before you begin:

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)

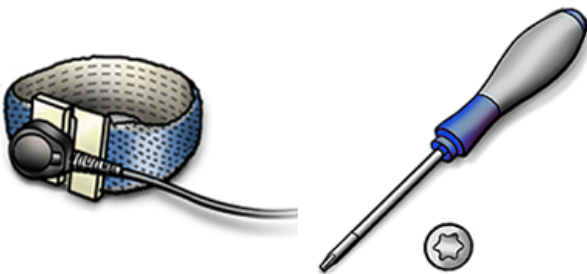
**iMac (Retina 5K, 27-inch, Late 2014)**





## Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)



## Steps For Removal

**Caution:** Check that data is backed up before removing the SSD card or flash storage. (Beginning in 2013 models, "flash storage" is the approved term for use.)

1. Remove one (1) T8 screw from the SSD card.

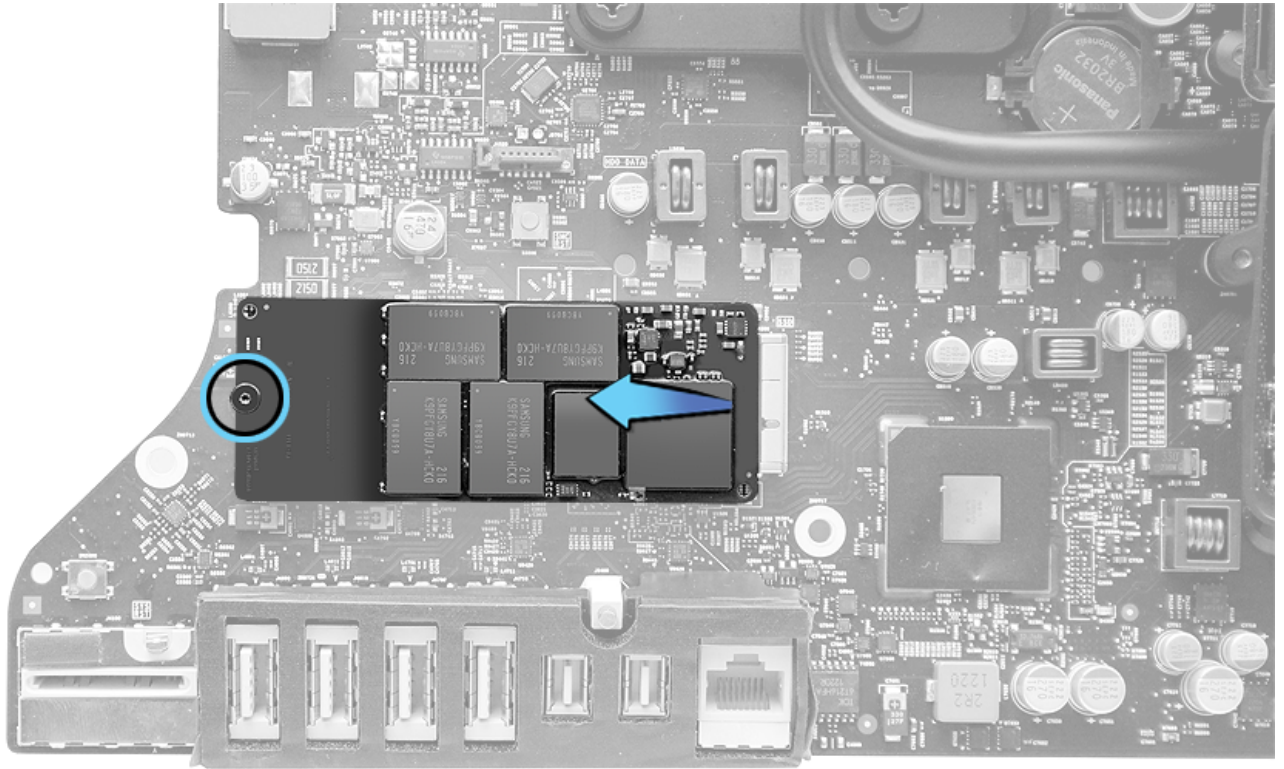
- 923-0328



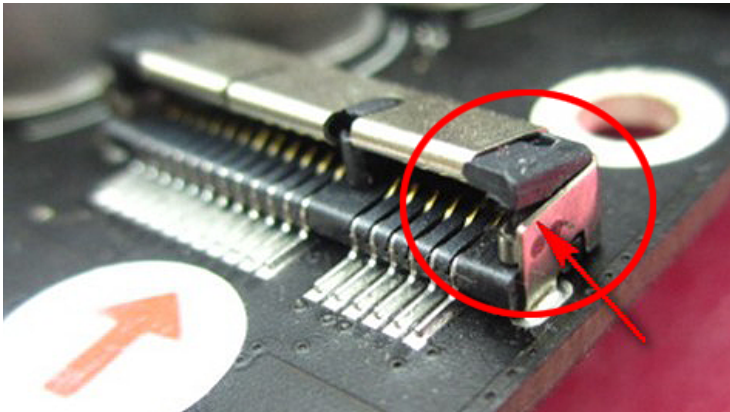
2. **Gently** pull the SSD card or flash storage straight out of the connector. **Caution:** Do not lift the flash storage at an angle when removing it from the connector. Lifting the the flash storage at an angle can damage the connector on the logic board



and warrant a logic board replacement.

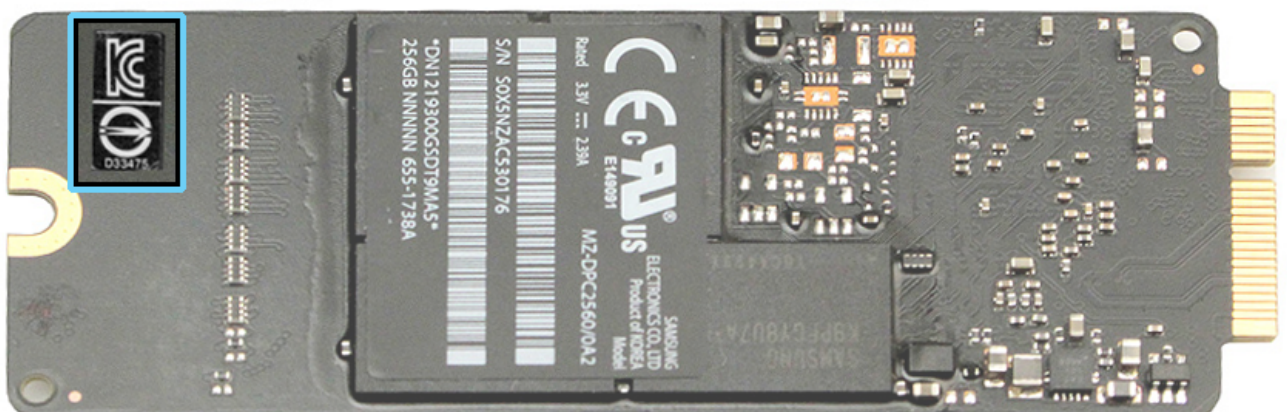


A wireless card connector shows the damage caused by lifting the wireless card at an angle during removal.



## Steps For Reassembly

1. Before installing a replacement card in the computer, remove the compliance label from the underside of the card.



2. Insert the SSD card or flash storage straight into the logic board connector. **Caution:** Do not lift the flash storage at an angle when inserting it into the connector. Lifting the flash storage at an angle can damage the flash storage connector on the logic board and warrant a logic board replacement.
3. Install one (1) T8 screw to the SSD card or flash storage.
4. Reassemble the computer.
5. Refer to Apple Support article [TP767: Reinstalling Software That Came with the Computer](#).

# Portables and Desktops (Late 2011 or later): Reinstalling Software That Came with the Computer

Refer to Apple Support article [HT4718: OS X: About OS X Recovery](#) for more information.

A connection to the Internet is required to complete this procedure.

**Note:** In some situations, a customer may have set an EFI password via a feature such as Find My Mac or FileVault. The customer must know the EFI password in order to perform a Mac OS X reinstall.

If you suspect that an EFI password was set, and the customer cannot remember the password, contact TCS for assistance using their normal escalation path. Refer to Apple Support article [TS3554: Recovering a lost firmware password](#) for more information about resetting EFI passwords.

**Important:** Apple recommends that customers back up data before any software restore procedure. Back up essential files before installing OS X and other applications. Apple is not responsible for any loss of data.

1. Choose Apple menu > Restart, then hold down the Command (⌘) and R keys while the computer restarts.  
**Note:** To force OS X Lion or OS X Mountain Lion into Internet Recovery, press and hold the Command-Option-R key combination while starting up the computer.
2. If the computer is not connected to the Internet, choose a network from the Wi-Fi menu (in the top-right corner of the screen).
3. Select "Reinstall OS X", then click Continue.
4. Follow the onscreen instructions. In the pane where you select a disk, select your current OS X disk (in most cases, it is the only one available).
5. To start the installation, click Install.

Check for and apply the latest software and firmware updates.

## iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Wireless Card

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

For video instruction, refer to Apple Support article [SV249: Wireless Card Replacement Video](#).

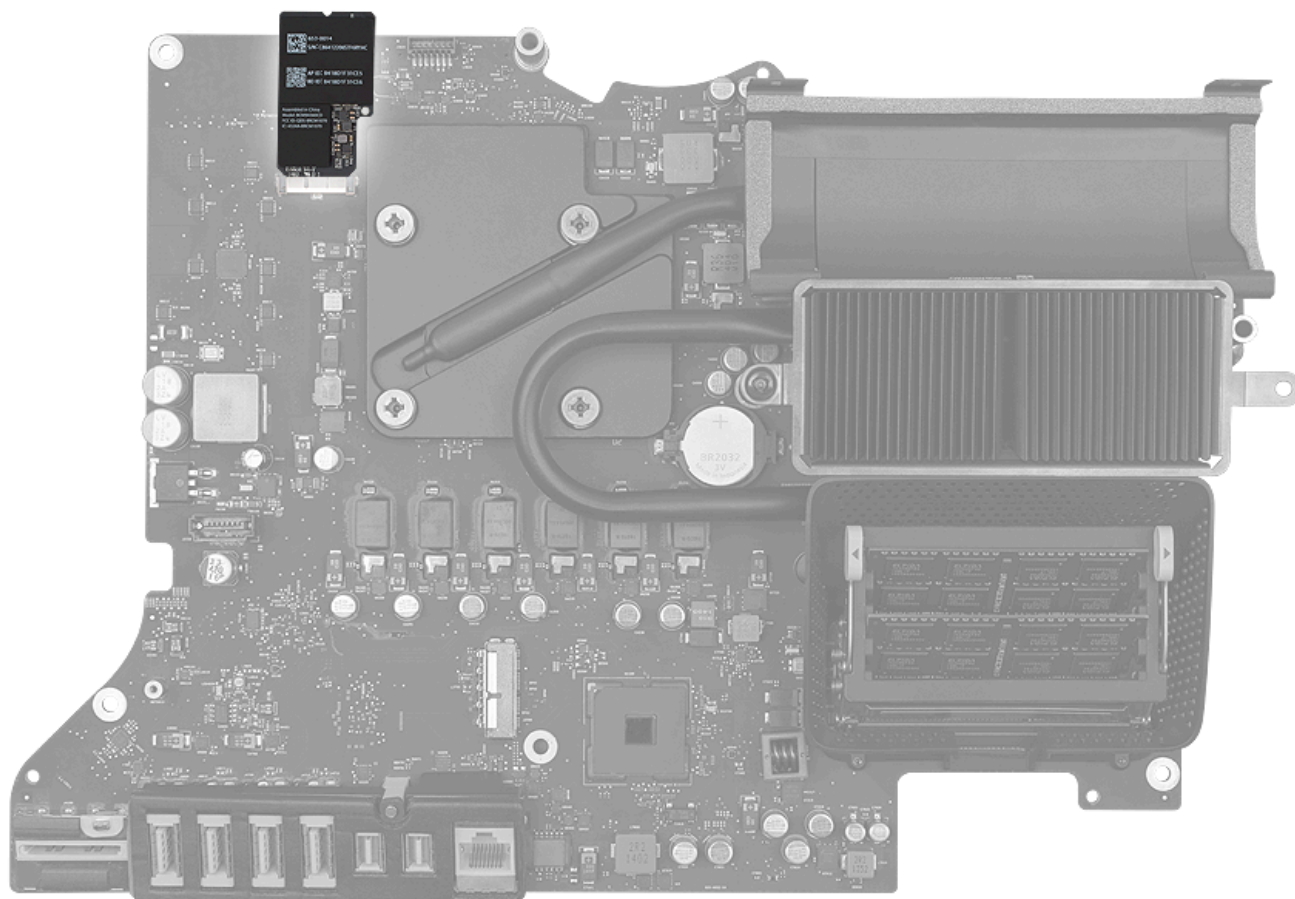
## Before you begin:

Remove:

- Display panel
- Display panel VHB strips
- Fan
- Chin strap
- Right speaker
- Left speaker
- Hard drive
- Power supply
- Logic board

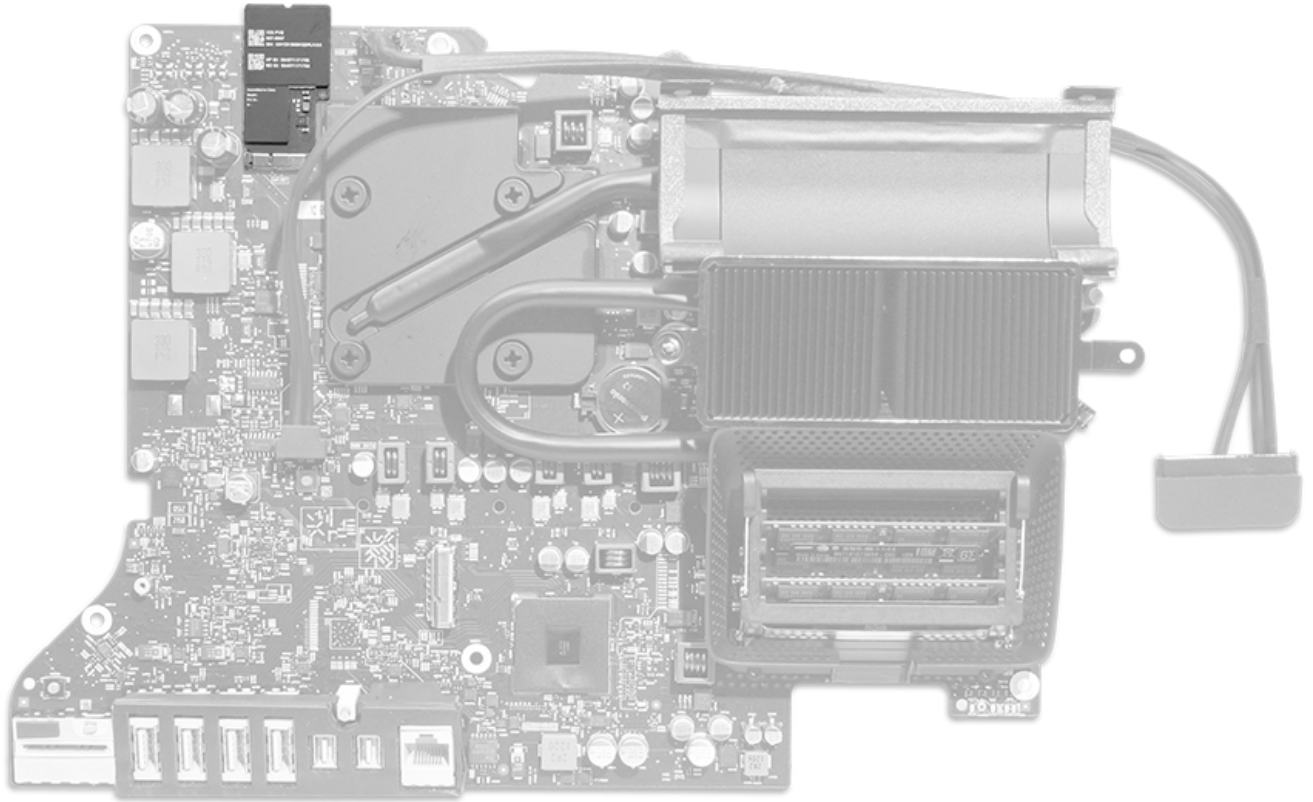
**Caution:** Do not remove the wireless card without taking out the logic board. Attempting to do this is likely to damage both the wireless card and the logic board. Additionally, the use of thermal material during installation will make it difficult to insert the card if the logic board has not been removed.

**iMac (Retina 5K, 27-inch, Late 2014)**



### iMac (27-inch, Late 2012 and Late 2013)



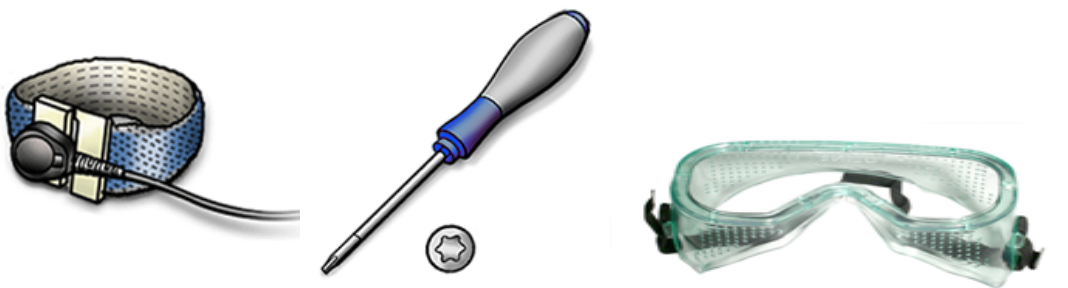


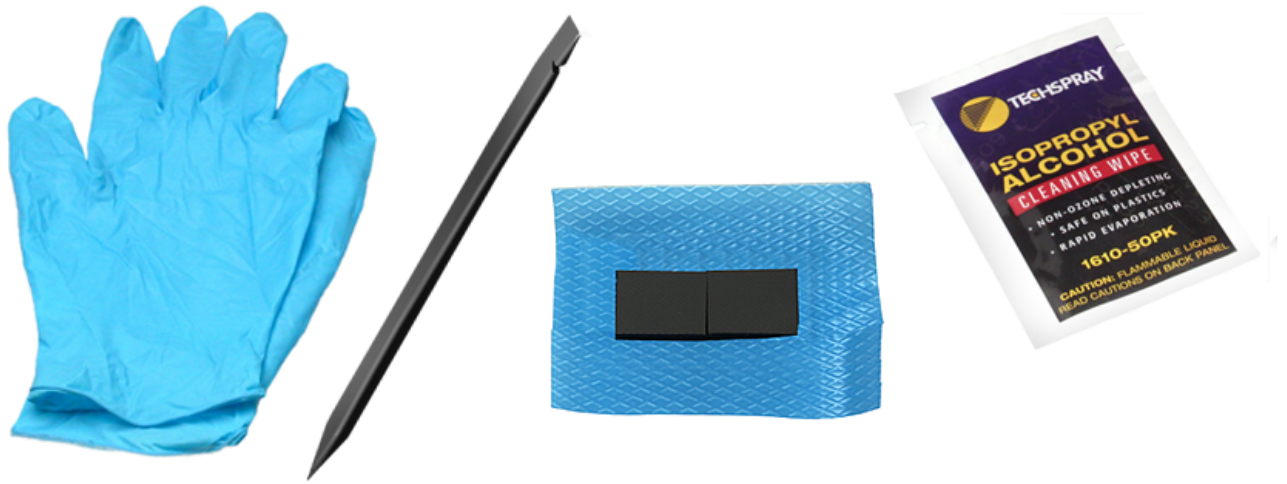
## Tools

- ESD wrist strap
- Torx T5 screwdriver (magnetized)
- Black stick
- Thermal pad kit, 076-1445 (replaces twinpak thermal material)
- Isopropyl alcohol (IPA) wipes
- Nitrile gloves (use when cleaning twinpak thermal material)
- Safety glasses (use when cleaning twinpak thermal material)
- Service wedge (iMac)

**Note:** On July 17, 2013, a thermal pad kit (076-1445) replaced the original twinpak of thermal material (076-1425) necessary for installing wireless cards in iMac (Late 2012 and Early 2013) models. The thermal pad kit is included with replacement wireless card and logic board parts on the iMac (Late 2012 and Early 2013) models. On the iMac (Late 2013 and later) models, the thermal pad is **only** included with the wireless card. The kit is also available separately (076-1445).

Whenever you remove or replace the wireless card in an iMac (Late 2012 and Early 2013) model, check for original thermal material. If it is present, remove the original thermal material, clean with an IPA wipe, and install one thermal pad to the wireless card.



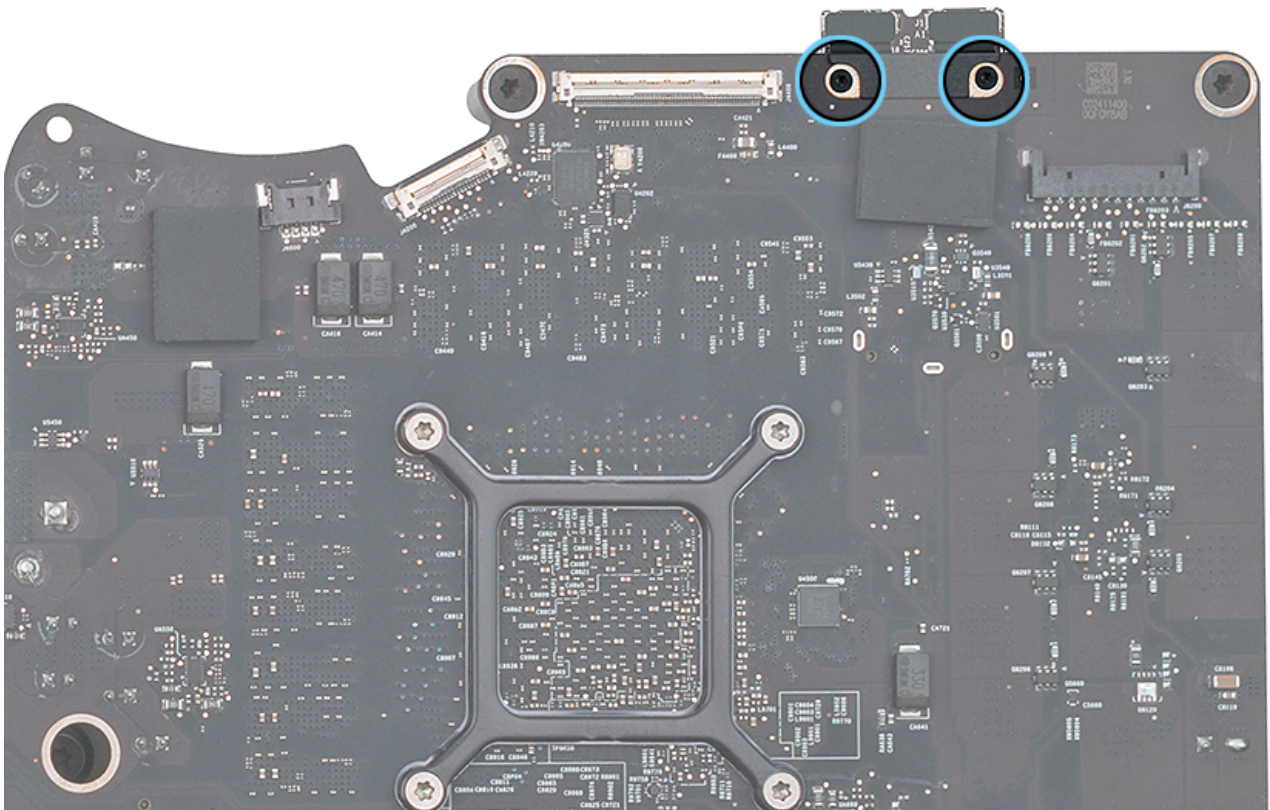


## Steps For Removal

1. Remove two (2) T5 screws from the wireless card.

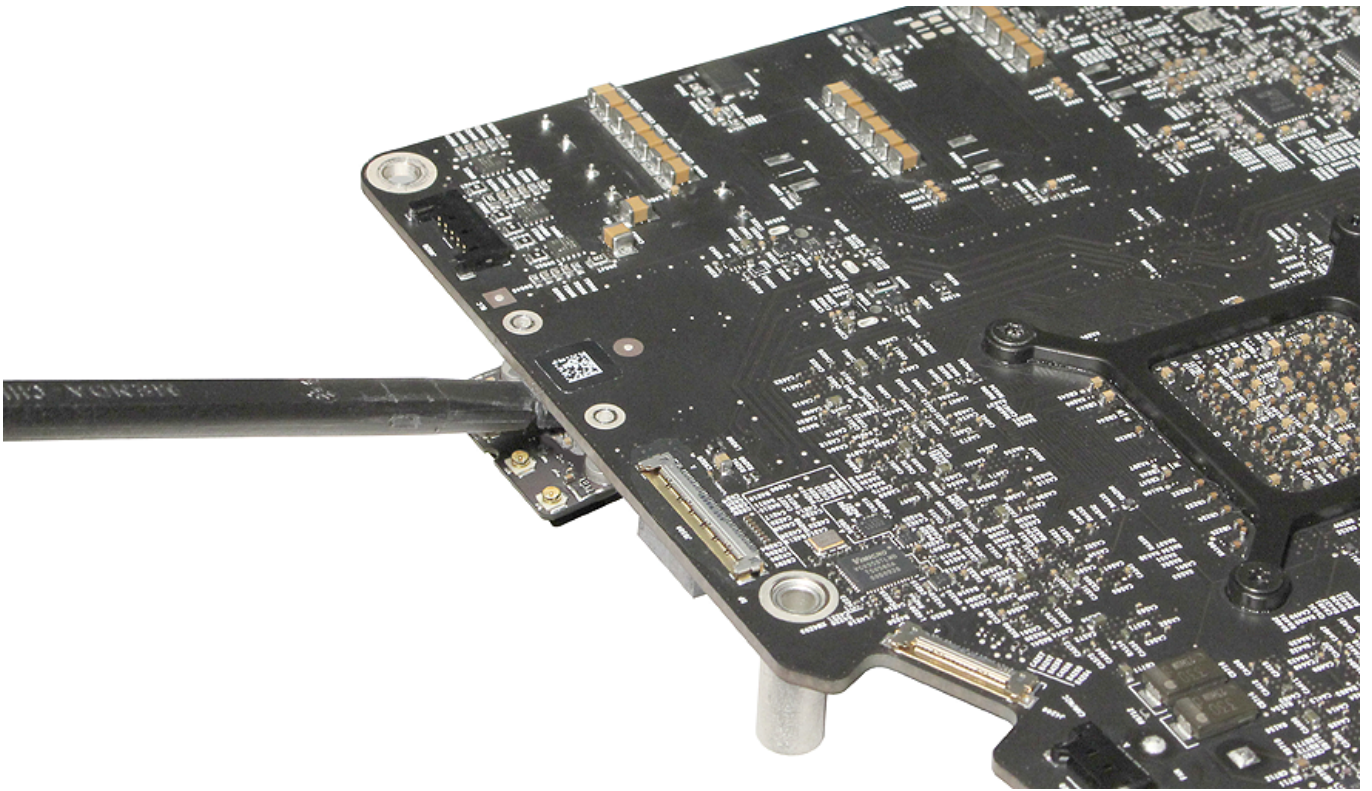
- 923-0394 (3mm)

**Note:** iMac (Retina 5K, 27-inch, Late 2014) uses Mylar tape to secure the antennas to the antenna connectors.



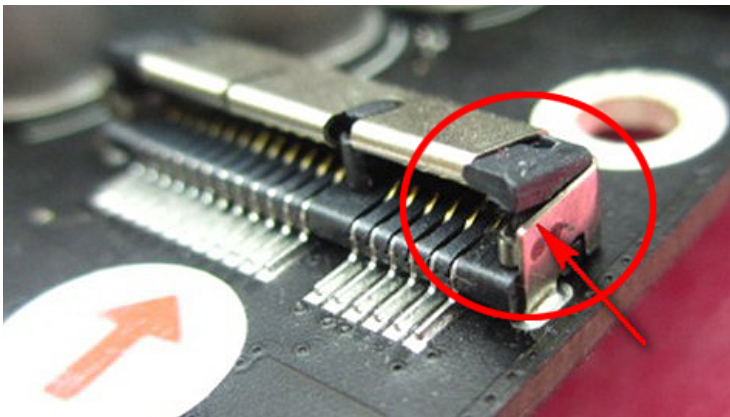
2. Use a black stick to gently loosen the bond of thermal material between the logic board and wireless card. **Important:** Exerting too much force when trying to loosen the bond of the thermal material could damage the wireless card connector (see the damaged connector in step 3).



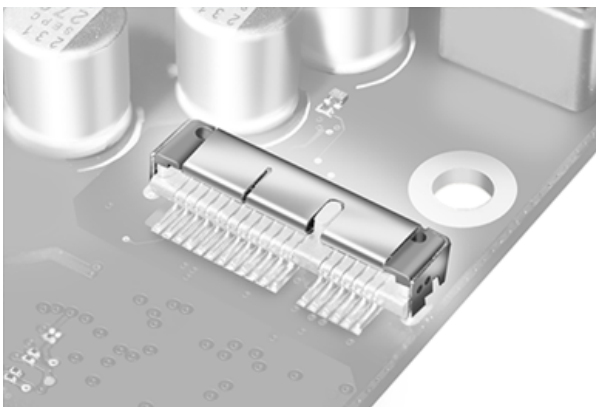


3. **Important:** A damaged wireless card connector requires a logic board replacement. **Note:** Damaged iMac (21.5-inch, Late 2012) wireless connector shown.

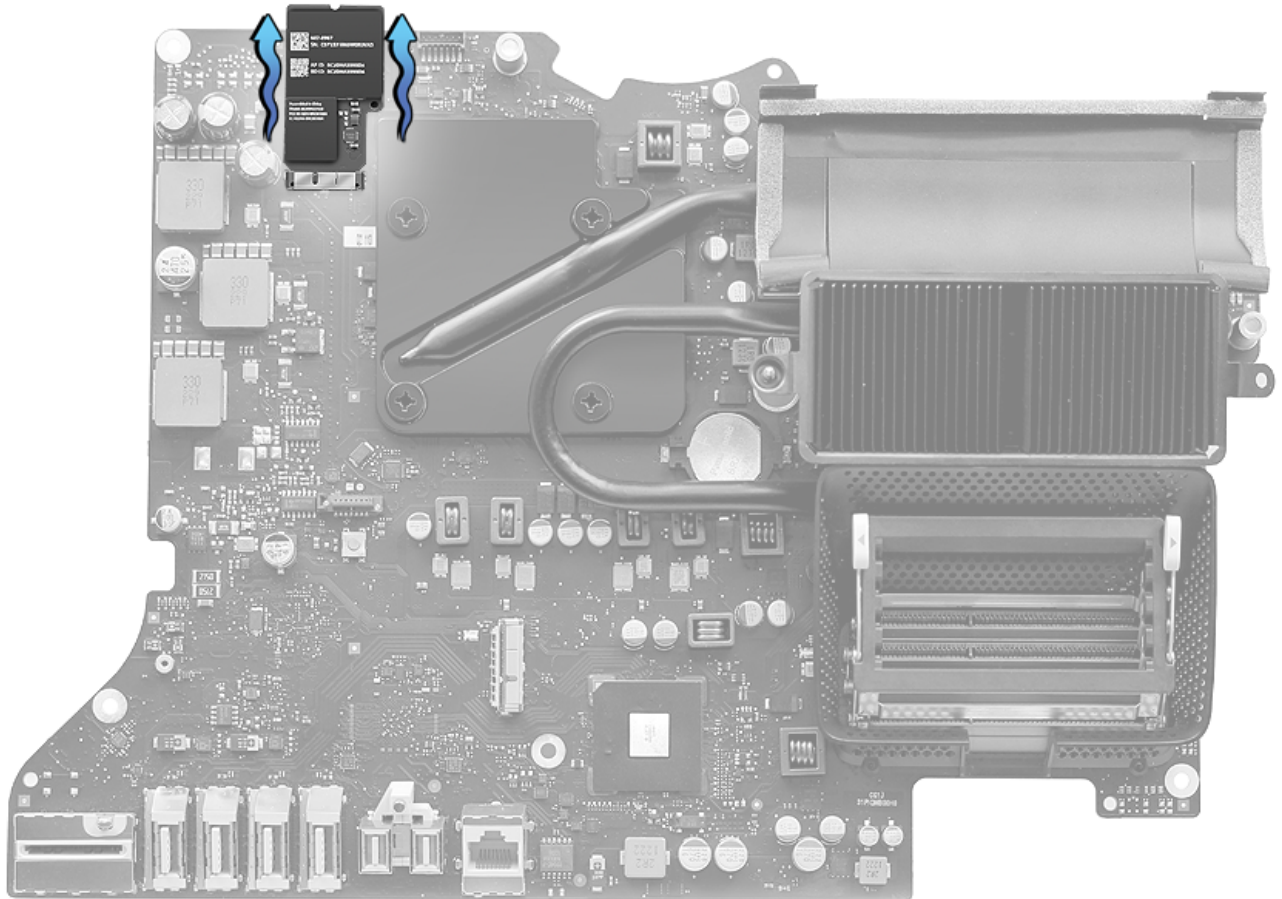
Damaged Wireless Card Connector



Wireless Card Connector With No Damage

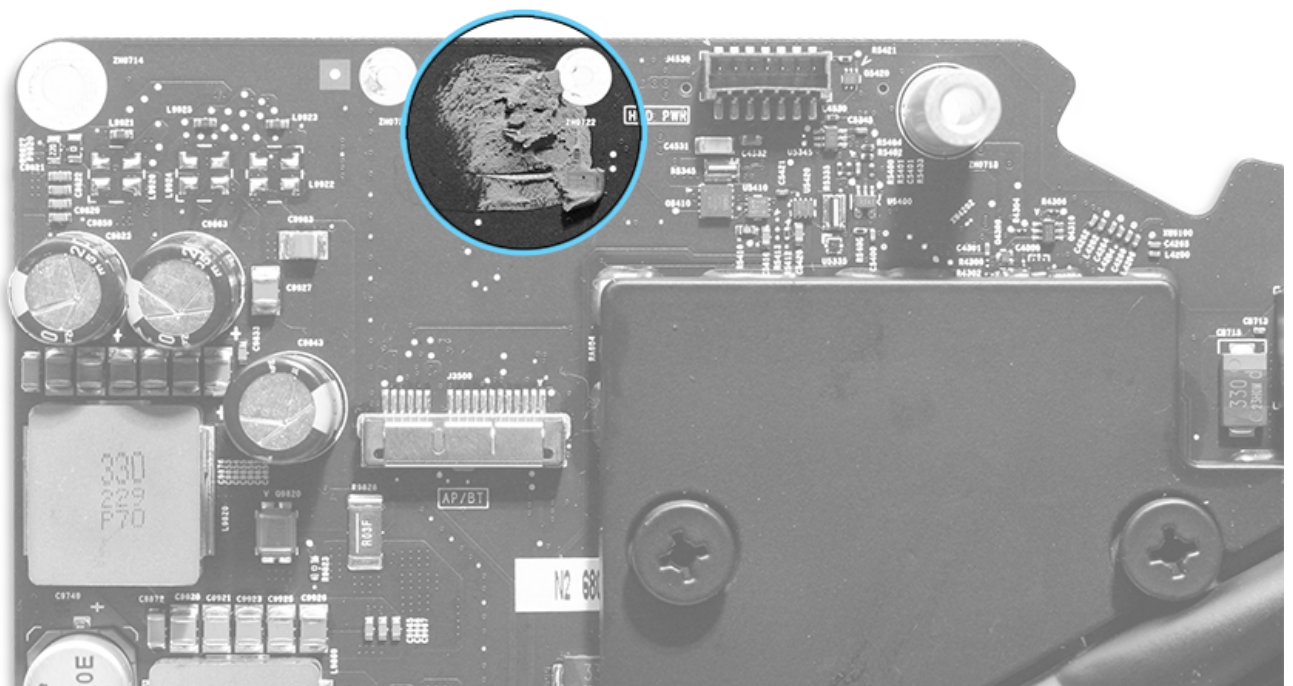


4. Gently wiggle the wireless card straight up and out of the wireless card connector.

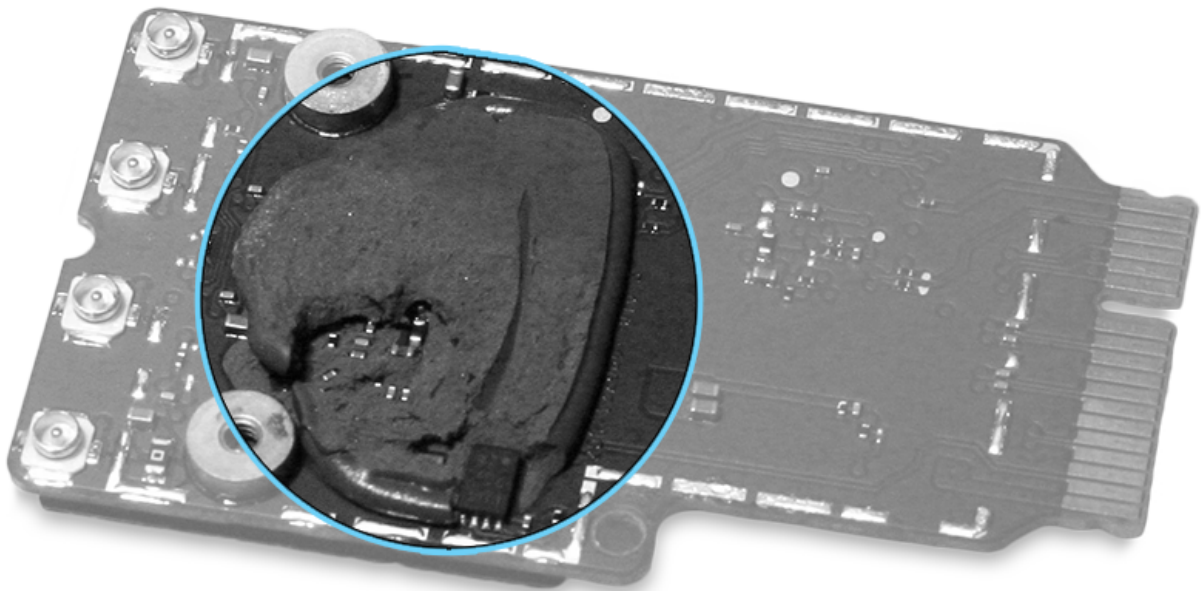


5. If thermal material is present, use a black stick to carefully remove the thermal material from both the logic board and wireless card. Clean both modules with IPA wipes.

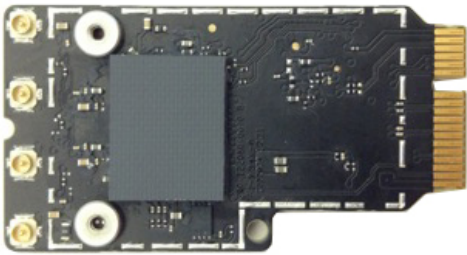
- **Logic board and wireless card with thermal material**







- Wireless card with thermal pad

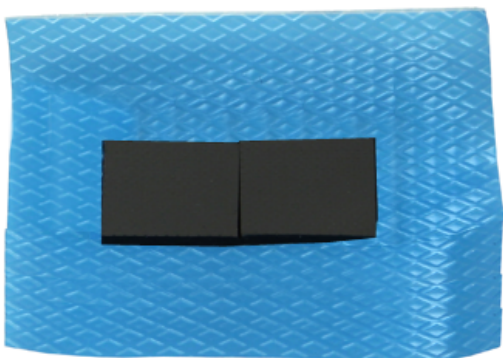


## Steps For Reassembly

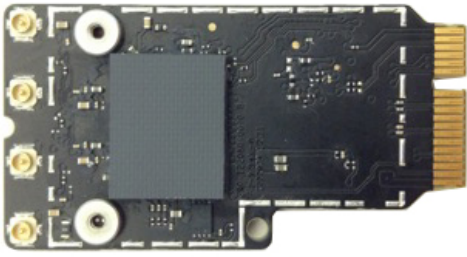
1. On July 17, 2013, a thermal pad kit replaced the original twinspace of thermal material (076-1425) necessary for installing wireless cards in iMac (Late 2012 and Early 2013) models. The thermal pad kit is included with wireless card and logic board replacement parts on the iMac (Late 2012 and Early 2013) models, and is available separately (076-1445). On the iMac (Late 2013 and later) models, the thermal pad is **only** included with the wireless card.

Whenever you remove or replace the wireless card in an iMac (Late 2012 and Early 2013), check for a dollop of original thermal material. If present, remove the original thermal material, clean with an IPA wipe, and install one thermal pad to the wireless card.

## Thermal pads

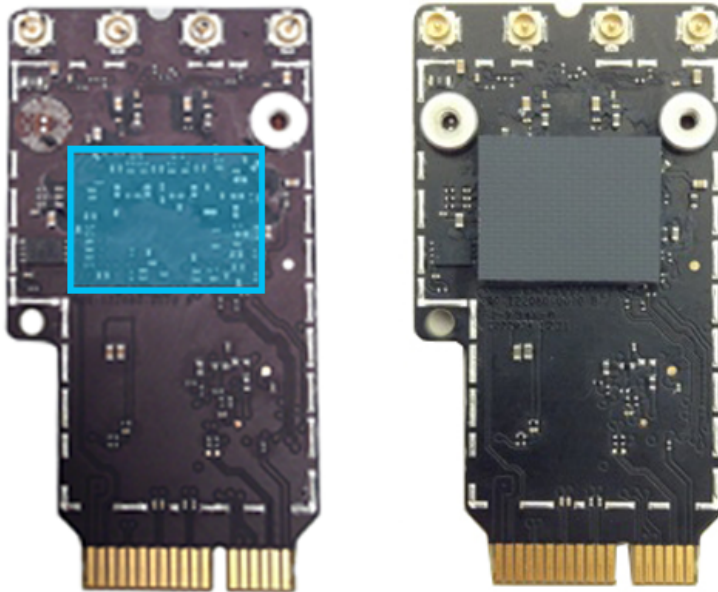


2. If the card has a thermal pad installed, check the condition of the thermal pad. Transfer the thermal pad to the replacement wireless card (unless it no longer adheres properly or is damaged).

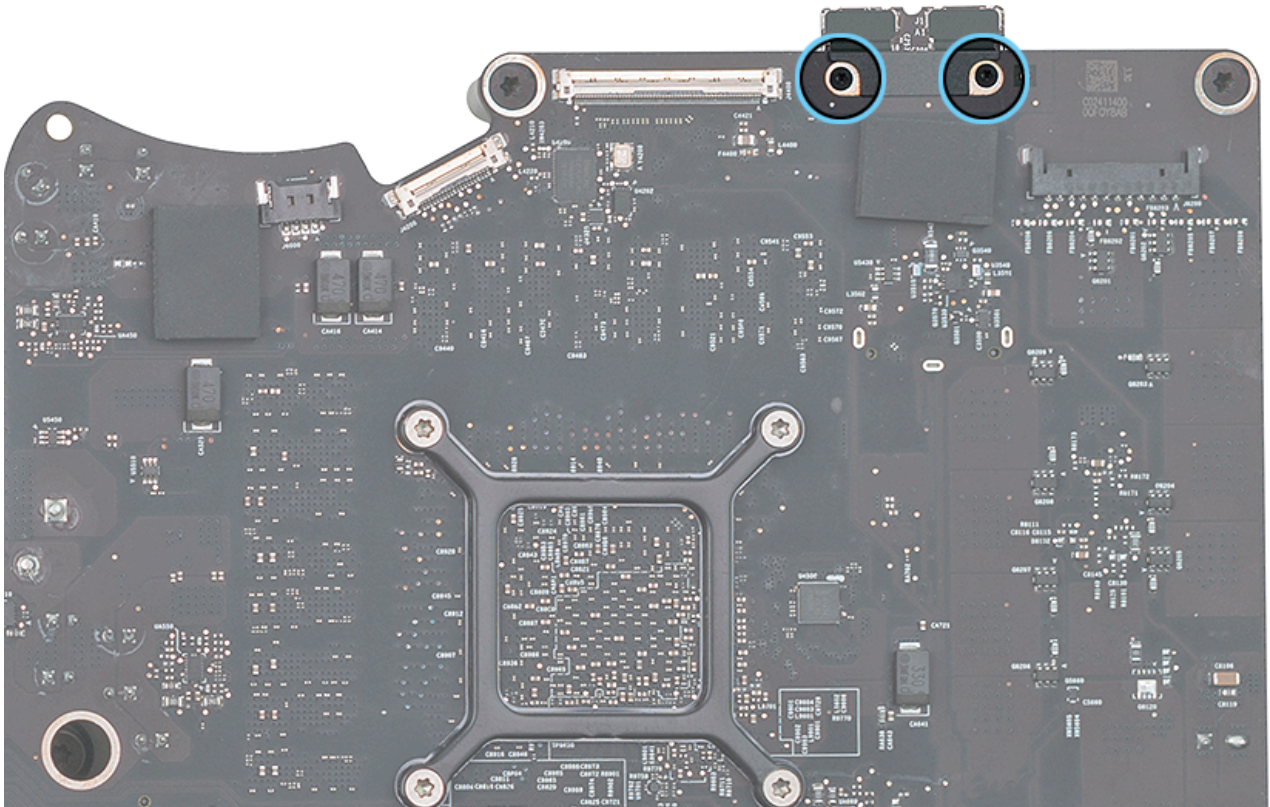


3. If the wireless card needs a thermal pad, attach one new thermal pad to the area indicated.

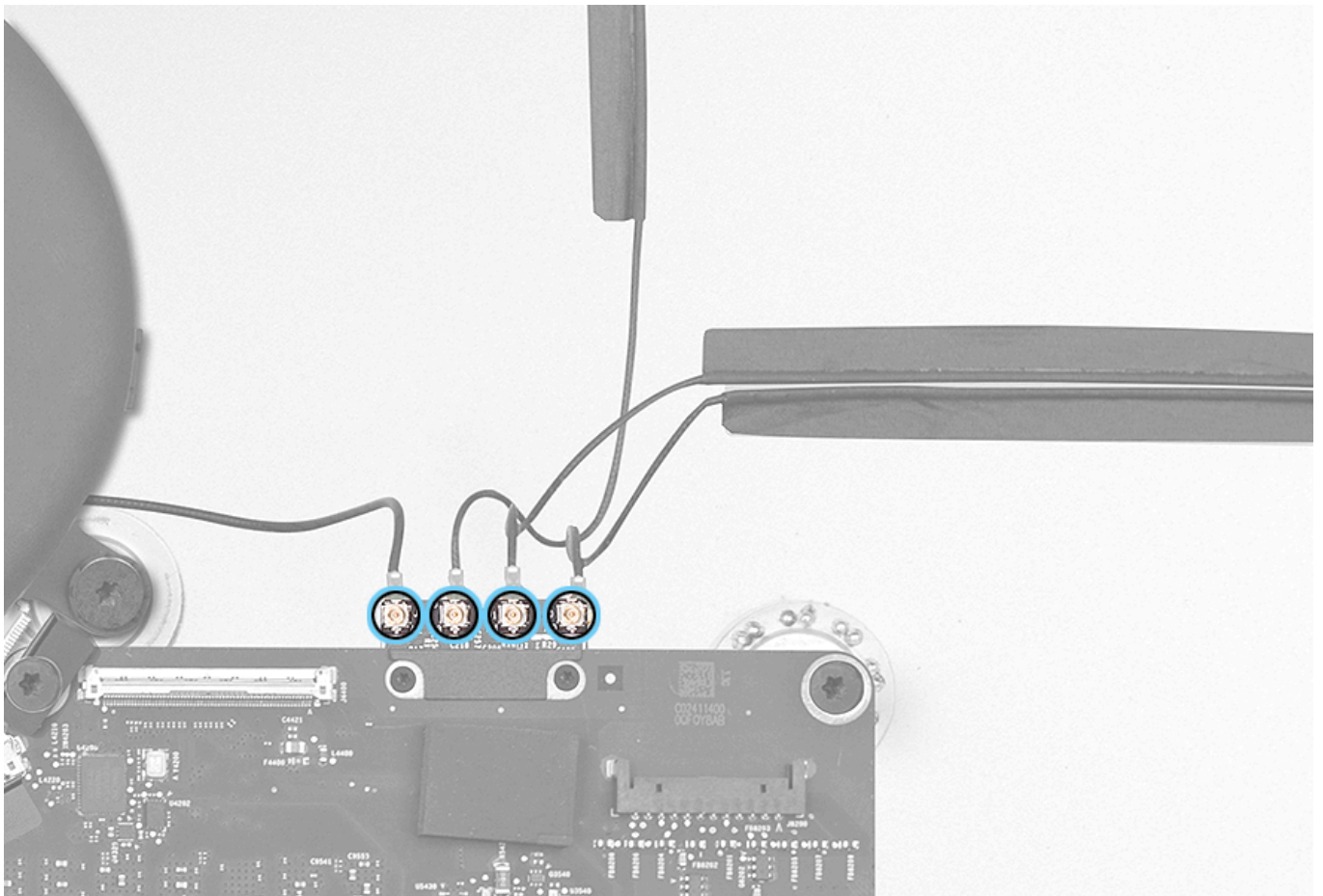
4. Align the wireless card and slide it into the connector on the logic board.



5. Reinstall the two (2) T4 wireless card screws (923-0394).

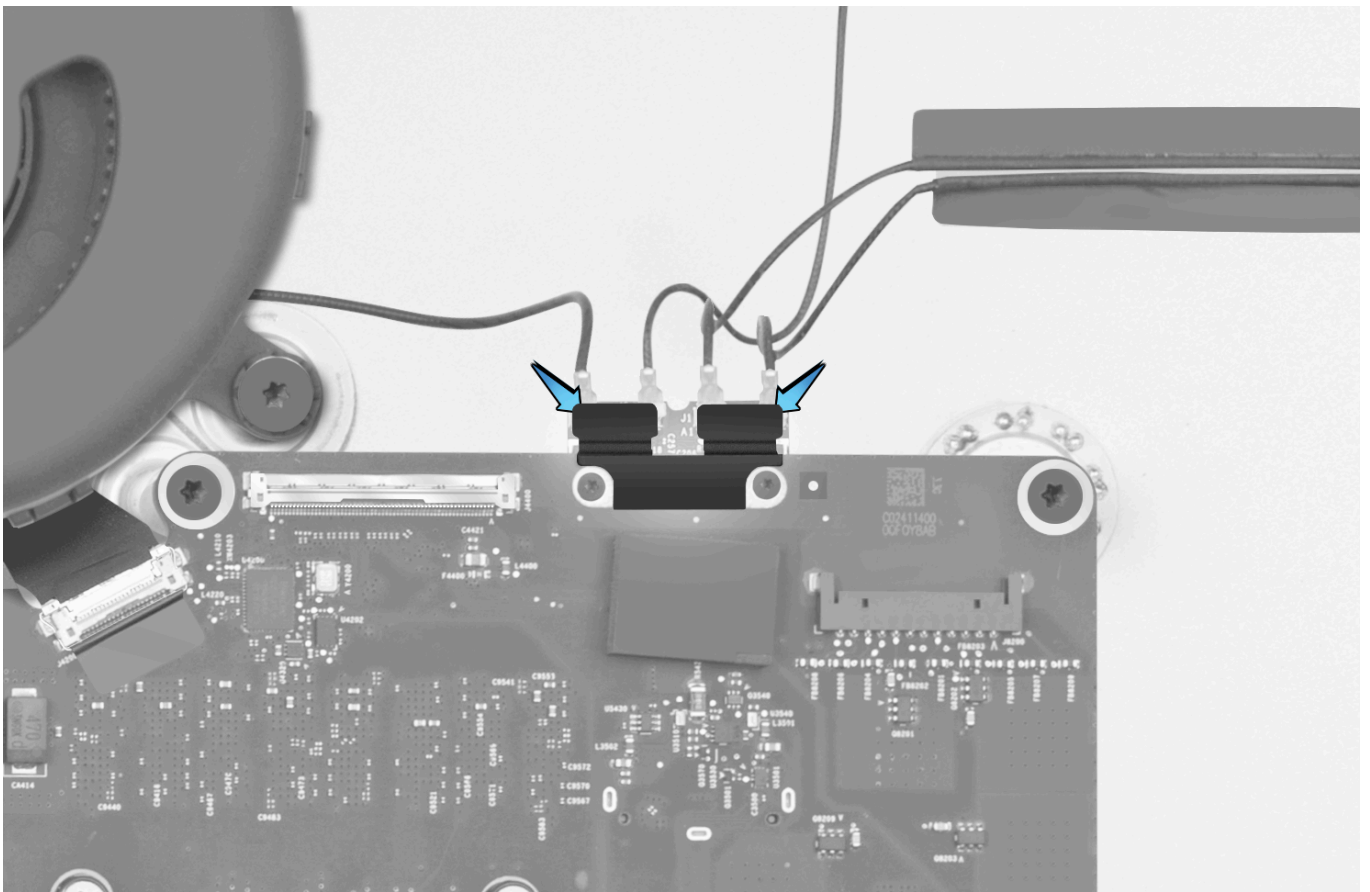


6. After installing the logic board, connect the antenna cables. Begin with the logo antenna (the left-most connector), then continue attaching the antennas clockwise (upper antenna, mid antenna, lower antenna).



7. For the iMac (Retina 5K, 27-inch, Late 2014), press the Mylar tape onto the antennas to secure the antennas to their connectors.





8. Replace the [power supply](#).
9. Replace the [hard drive](#).
10. Replace the [left speaker](#).
11. Replace the [right speaker](#).
12. Replace the [chin strap](#).
13. Replace the [fan](#).
14. Replace the [display panel VHB strips](#).
15. Replace the [display panel](#).



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Battery

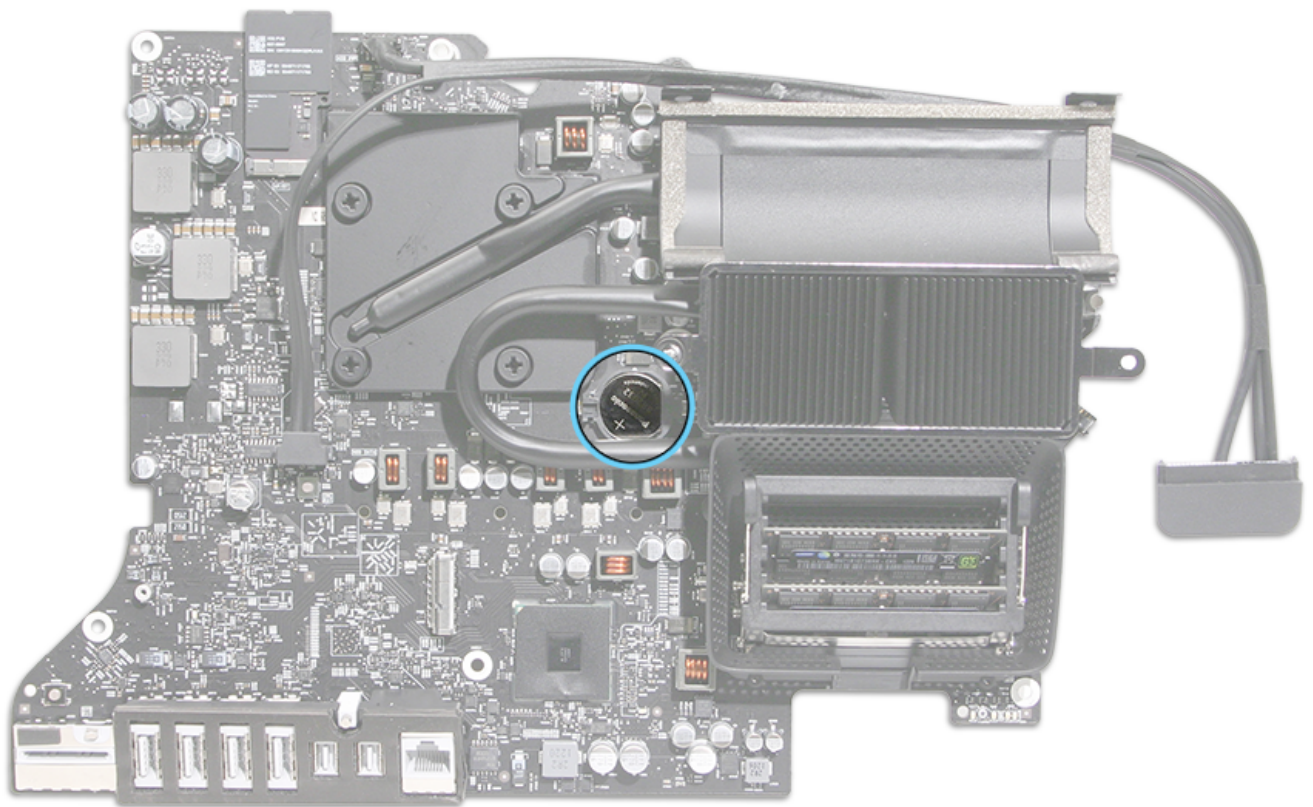
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



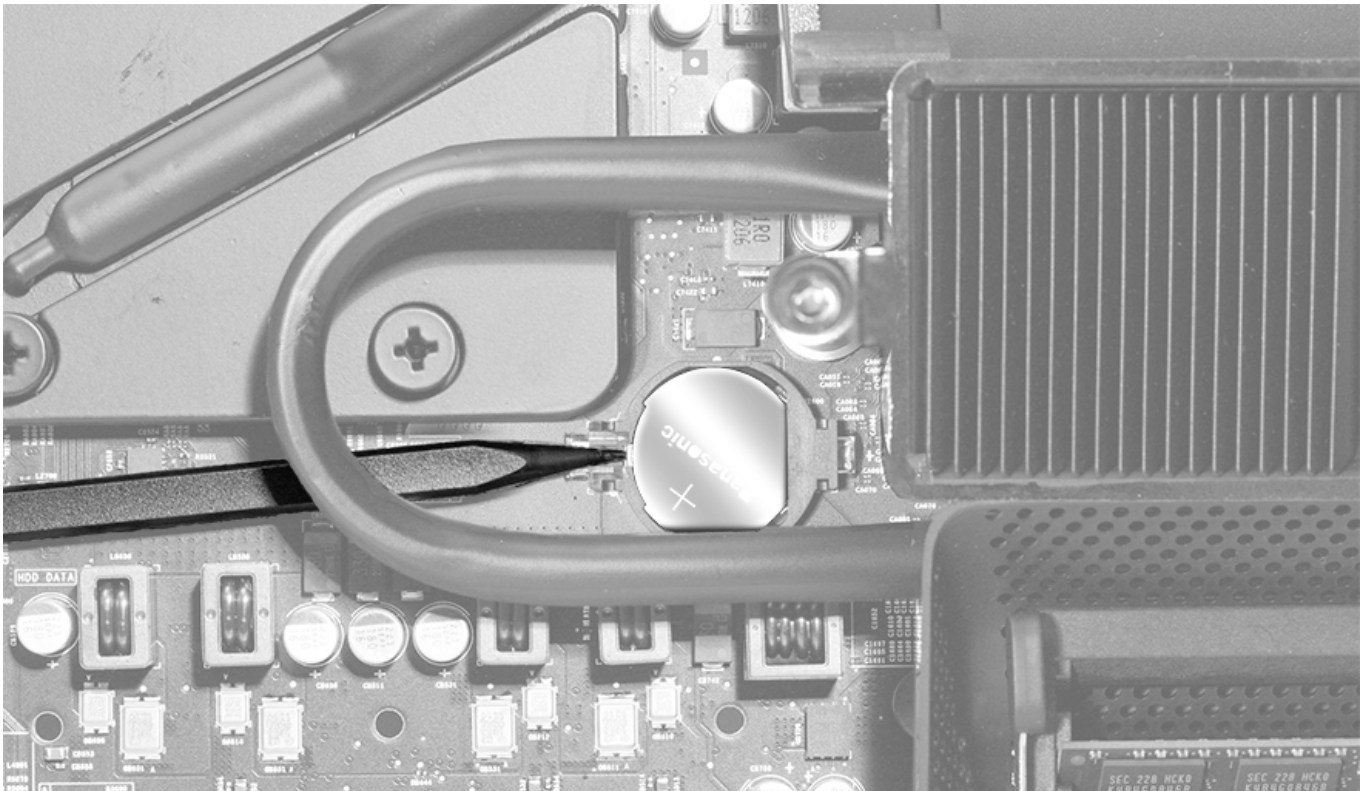
## Tools

- ESD mat and wrist strap
- Black stick
- Service wedge (iMac)



## Steps For Removal

1. Use a black stick to push the battery into the battery socket. The battery will spring out of the socket.



## Steps For Reassembly

**Warning:** If the battery is installed incorrectly or replaced with an incorrect type of battery, there is a risk of explosion. Dispose of used batteries according to local environmental laws and guidelines.

1. Check that the battery socket is open and free of dust.
2. Slide the battery (922-9869) into the socket with the engraved markings (+ side) facing up.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Hard Drive Data and Power Cable

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

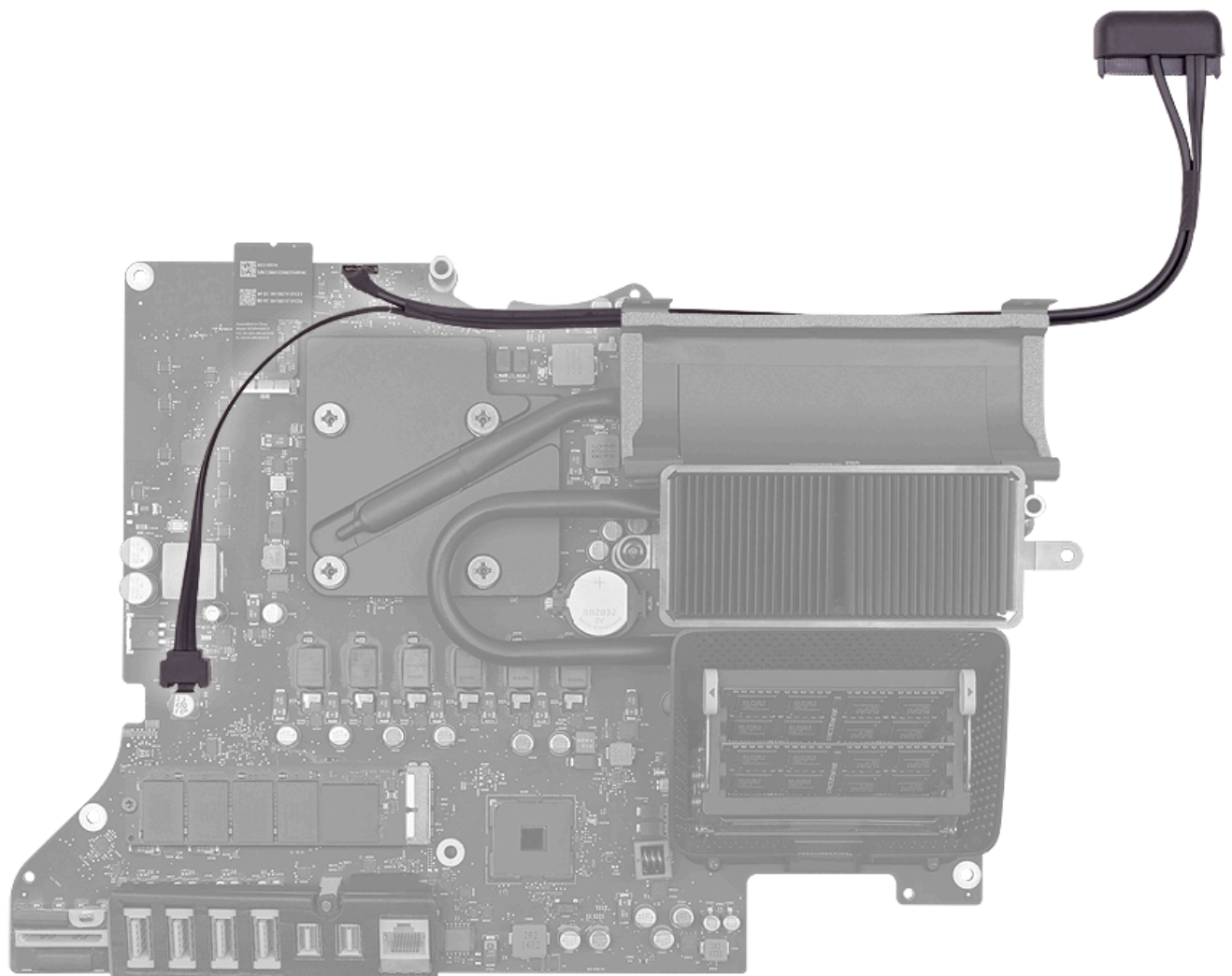
For video instruction, refer to Apple Support article [SV247: Hard Drive Cables Replacement Video](#).

Before you begin:

Remove:

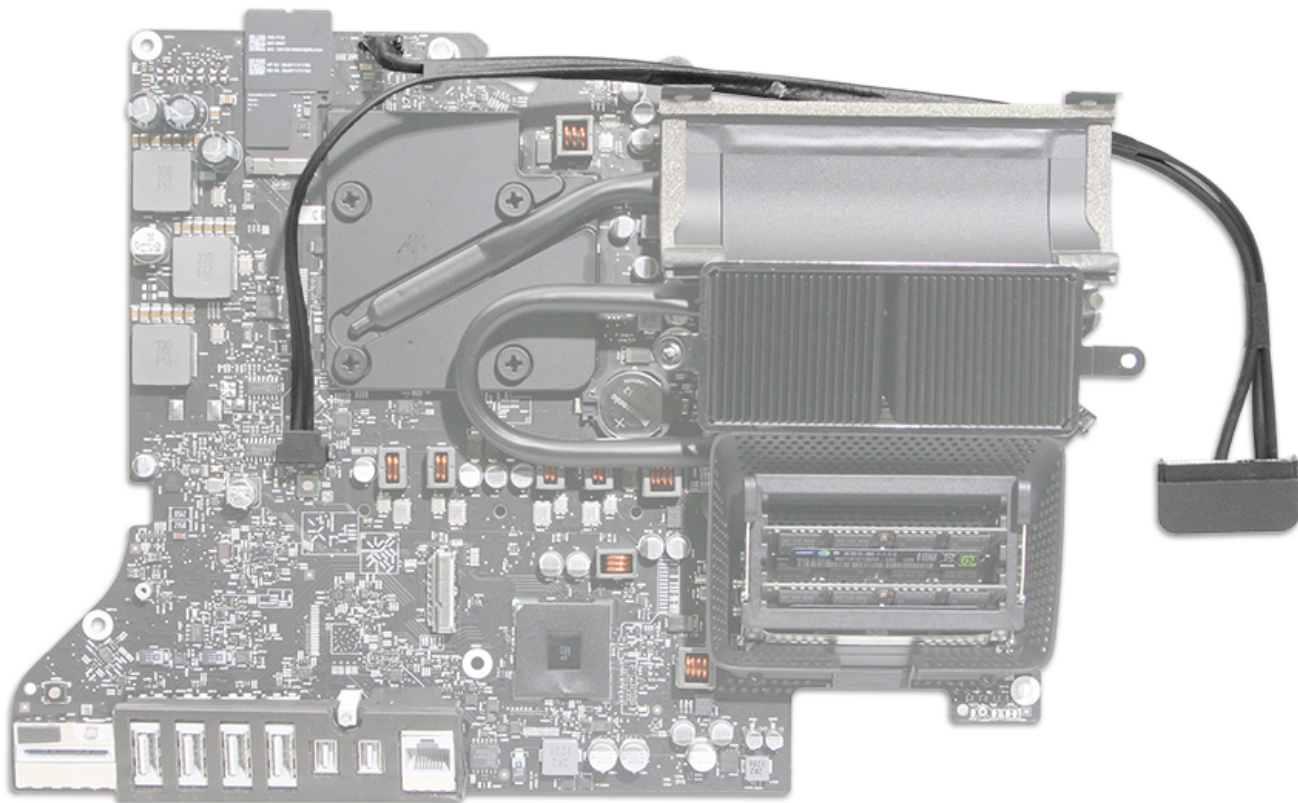
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)

**iMac (Retina 5K, 27-inch, Late 2014)**





## iMac (27-inch, Late 2012 and Late 2013)



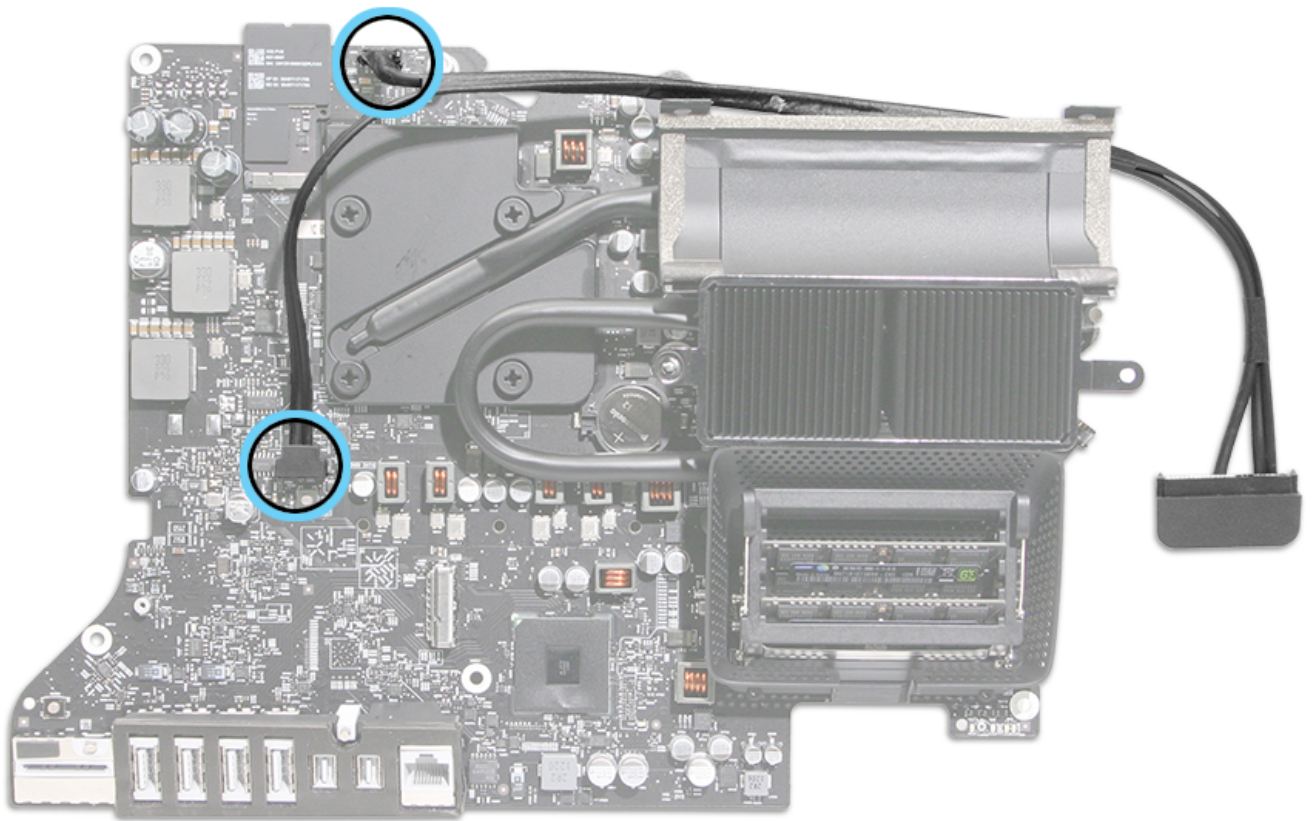
### Tools

- ESD wrist strap and mat



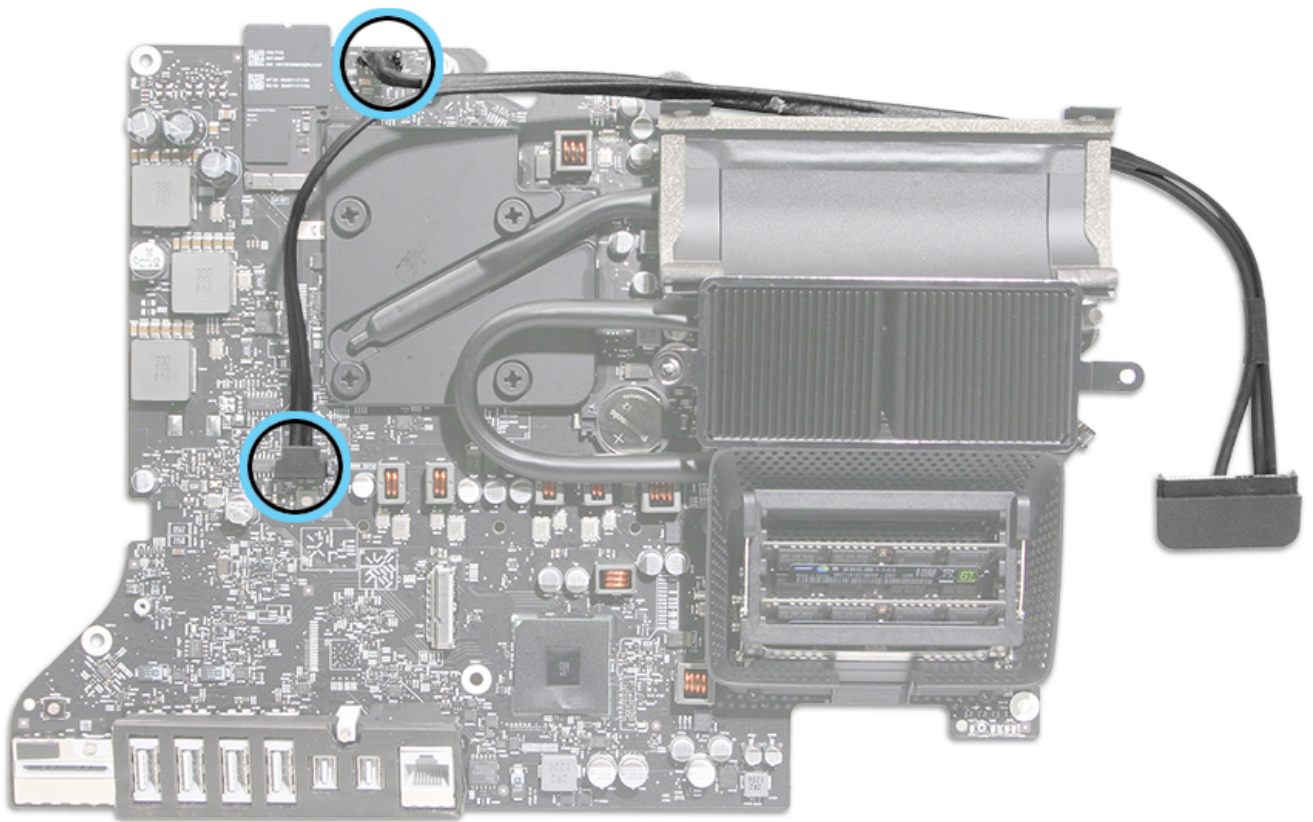
### Steps For Removal

1. Disconnect the hard drive data and power cable from the two connectors on the logic board.



## Steps For Reassembly

1. Connect the hard drive data and power cable to the two connectors on the logic board.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): RAM Access Door Lock Mechanism

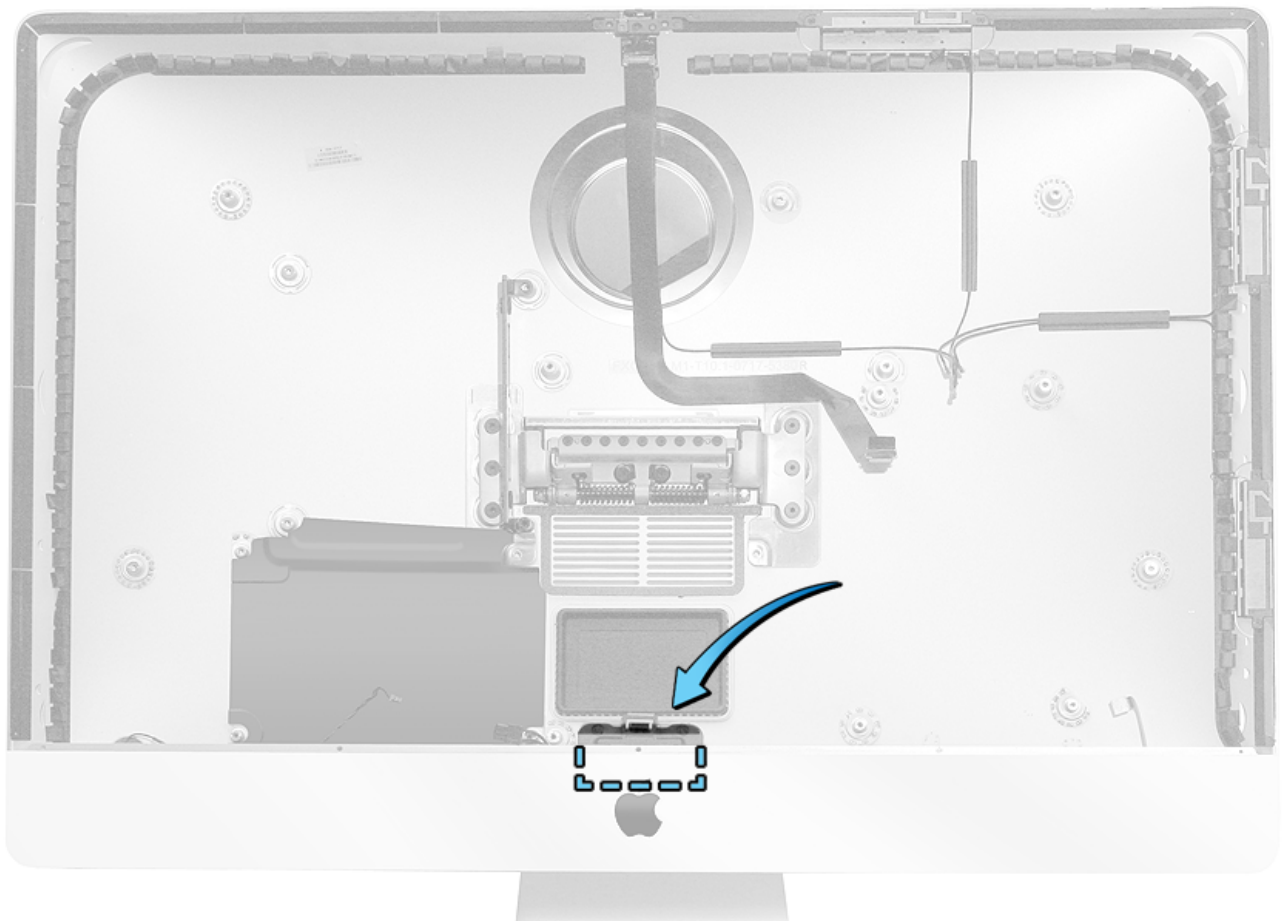
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

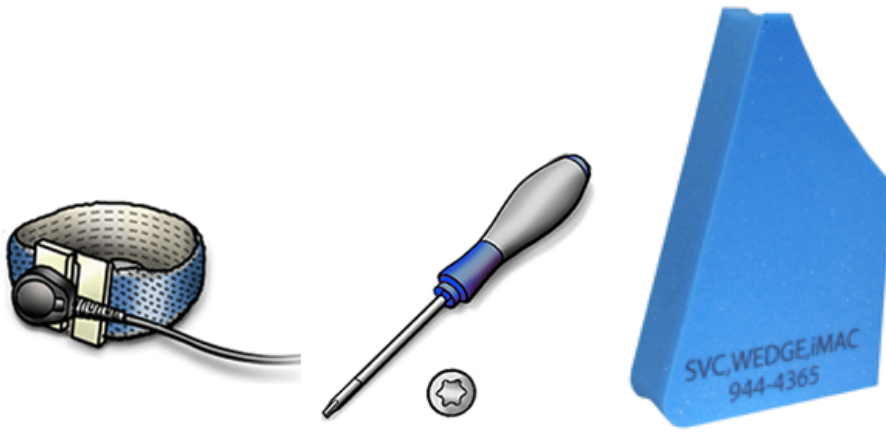
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



## Tools

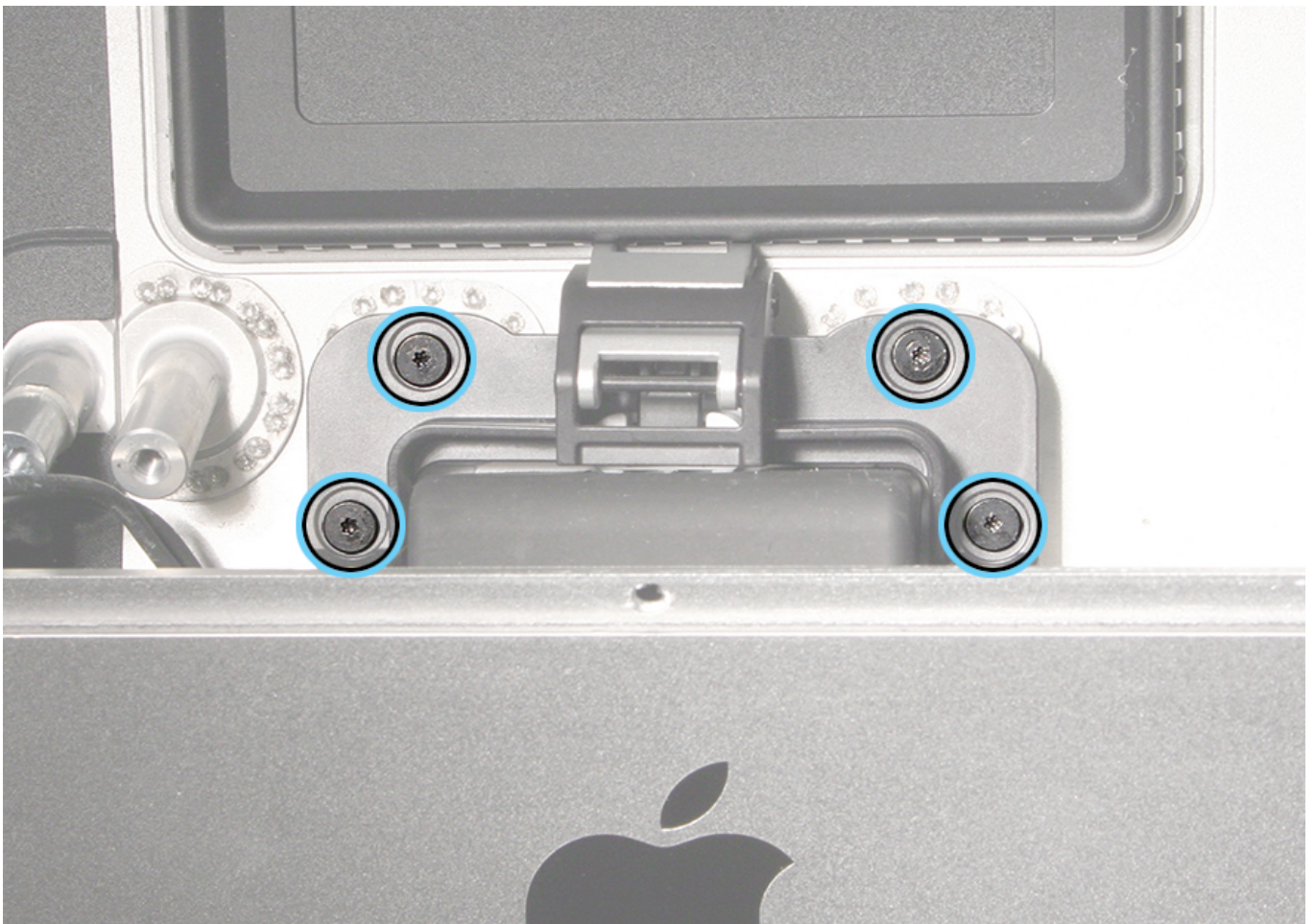
- ESD wrist strap and mat
- Torx T5 screwdriver (magnetized)
- Service wedge (iMac)





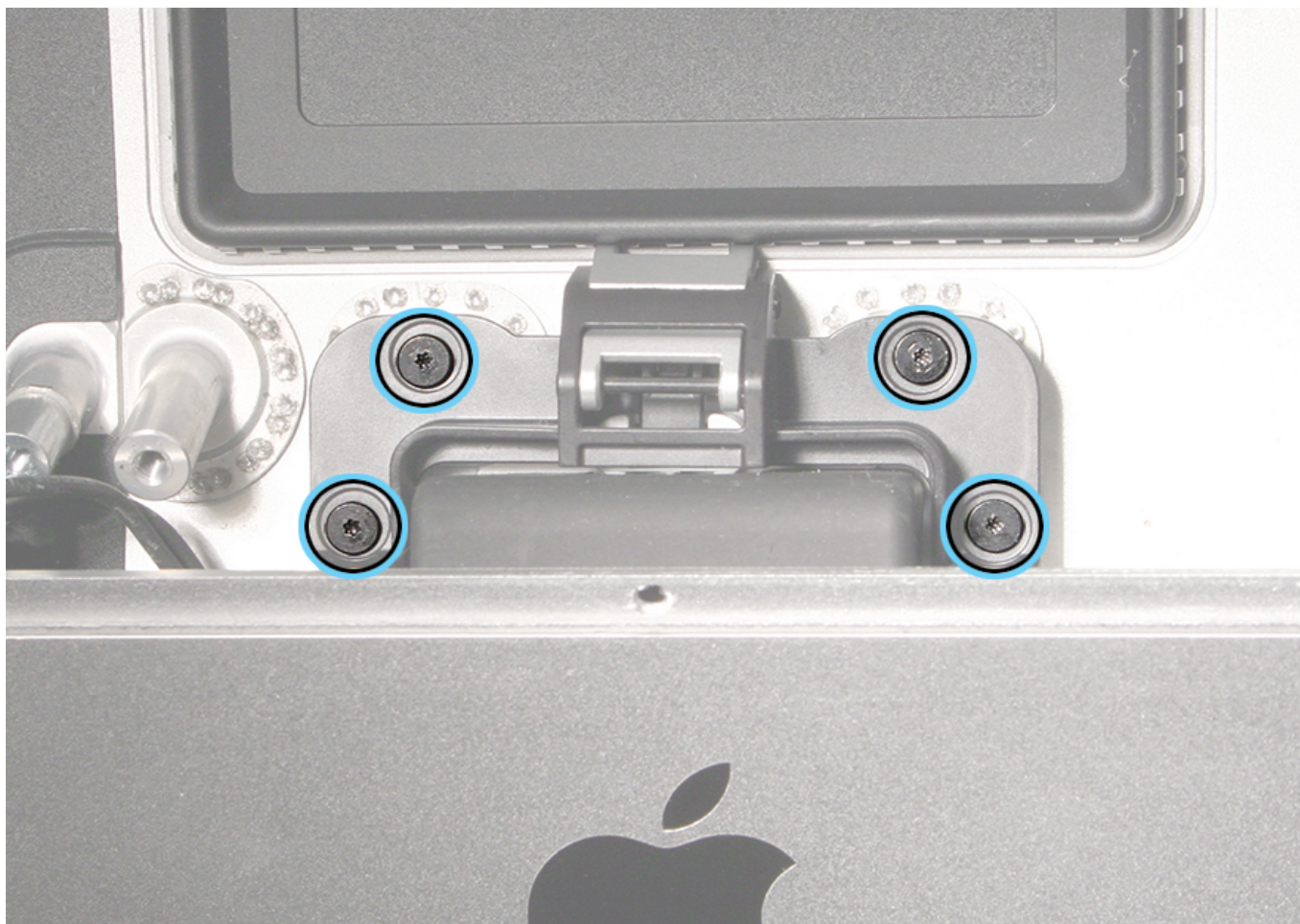
### Steps For Removal

1. Remove four (4) T5 (6.5mm) screws (923-0404).
2. Lift the RAM access door lock mechanism out of the rear housing.



### Steps For Reassembly

1. Insert the RAM access door into the rear housing. Line up the screw holes.
2. Install the four (4) T5 screws.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Stand

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

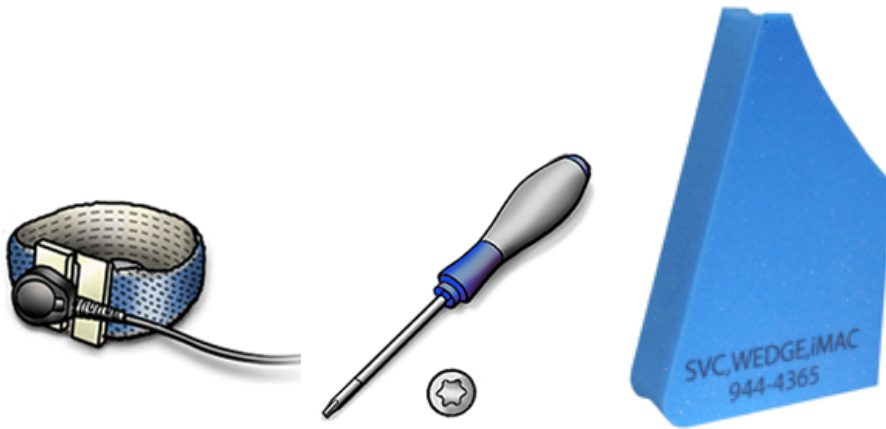
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)



## Tools

- ESD wrist strap and mat
- Torx T8 screwdriver (magnetized)
- Service wedge (iMac)

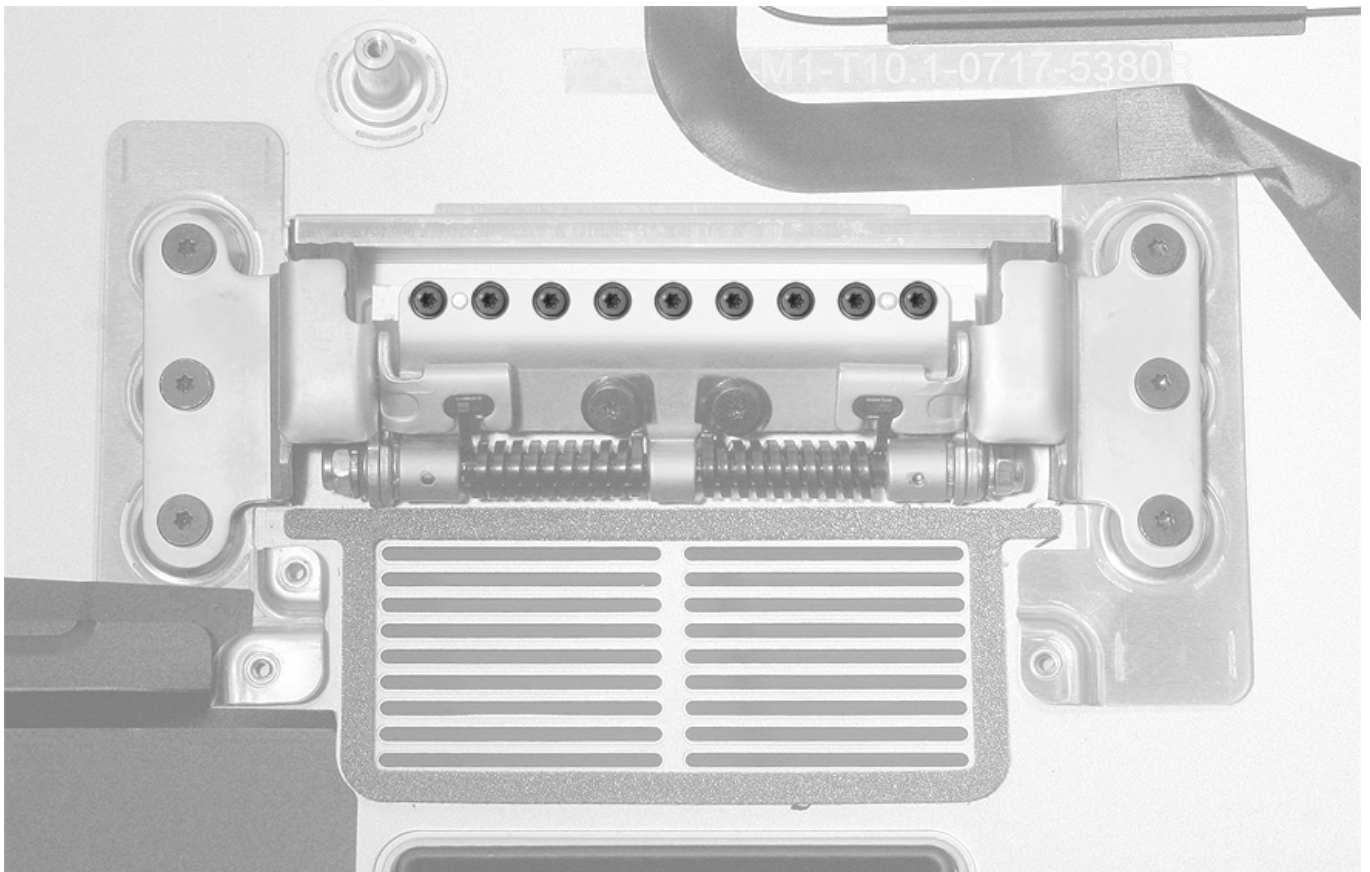




## Steps For Removal

1. Remove nine (9) T8 screws.

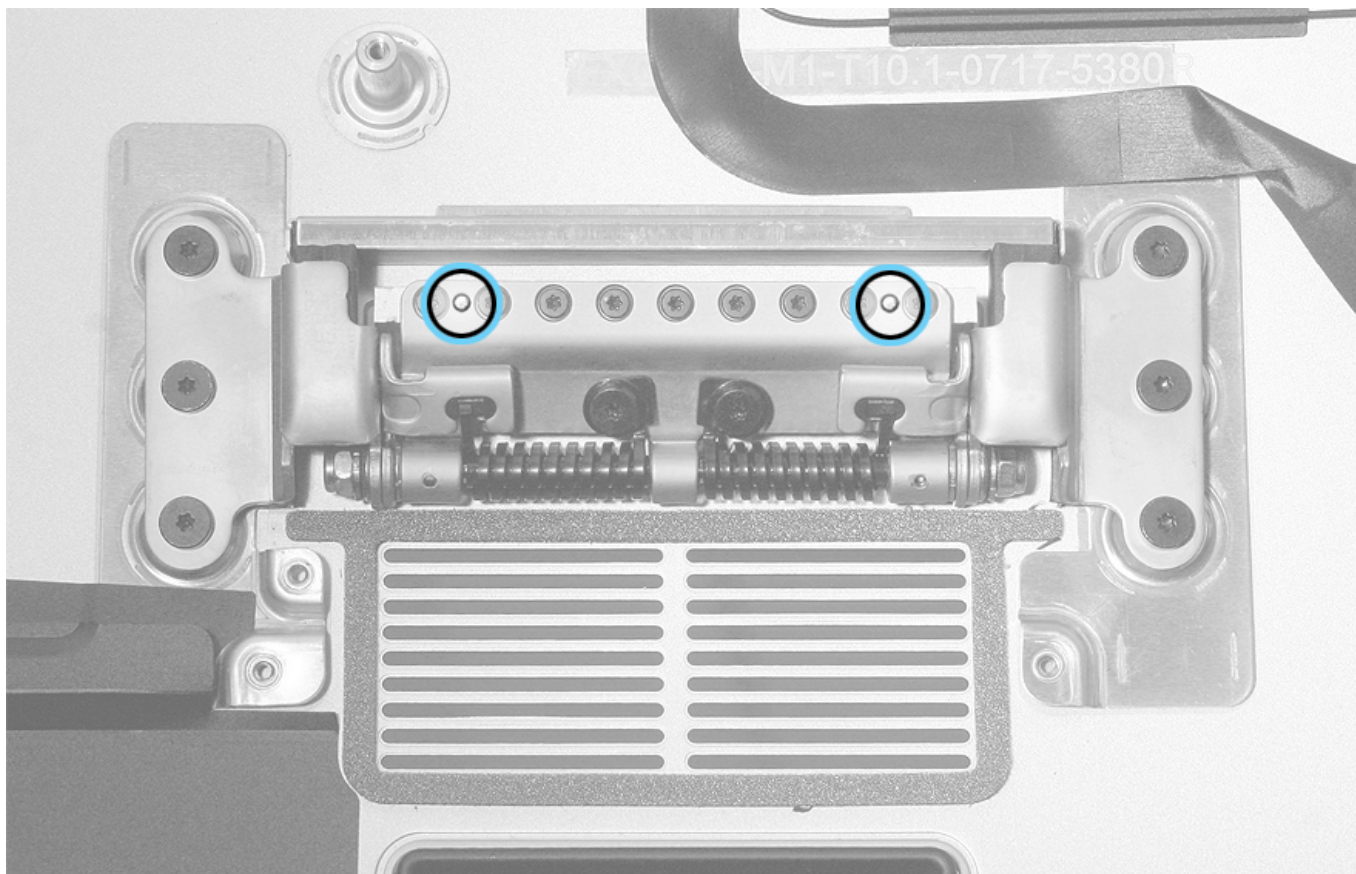
- 923-0329, 7.5 mm



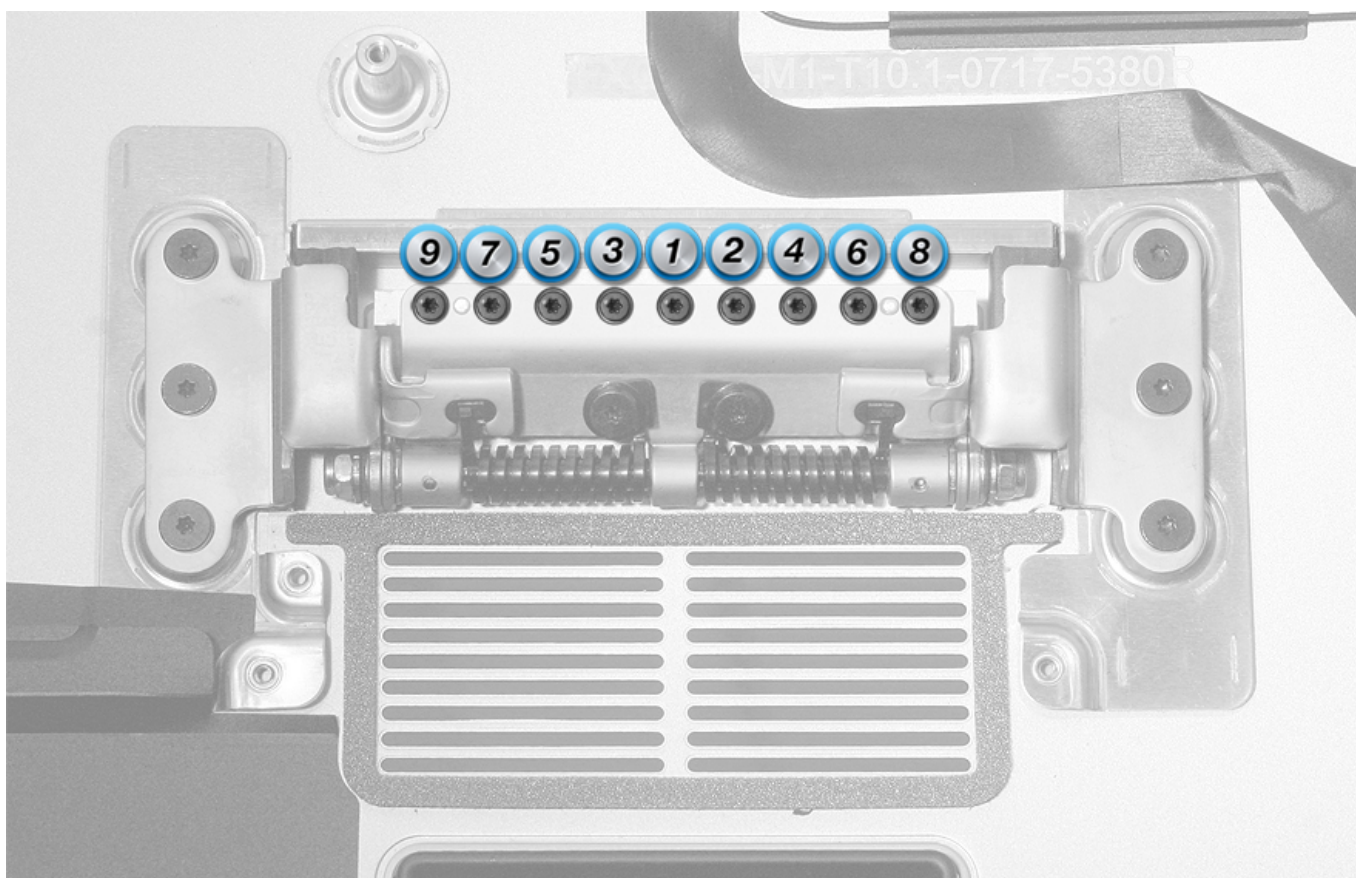
2. Lift the rear housing off of the stand, separating the stand from the mechanism.

## Steps For Reassembly

1. Line up the two pins on the stand with the pin holes on the mechanism.



2. Replace the screws in the following order.



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Mechanism

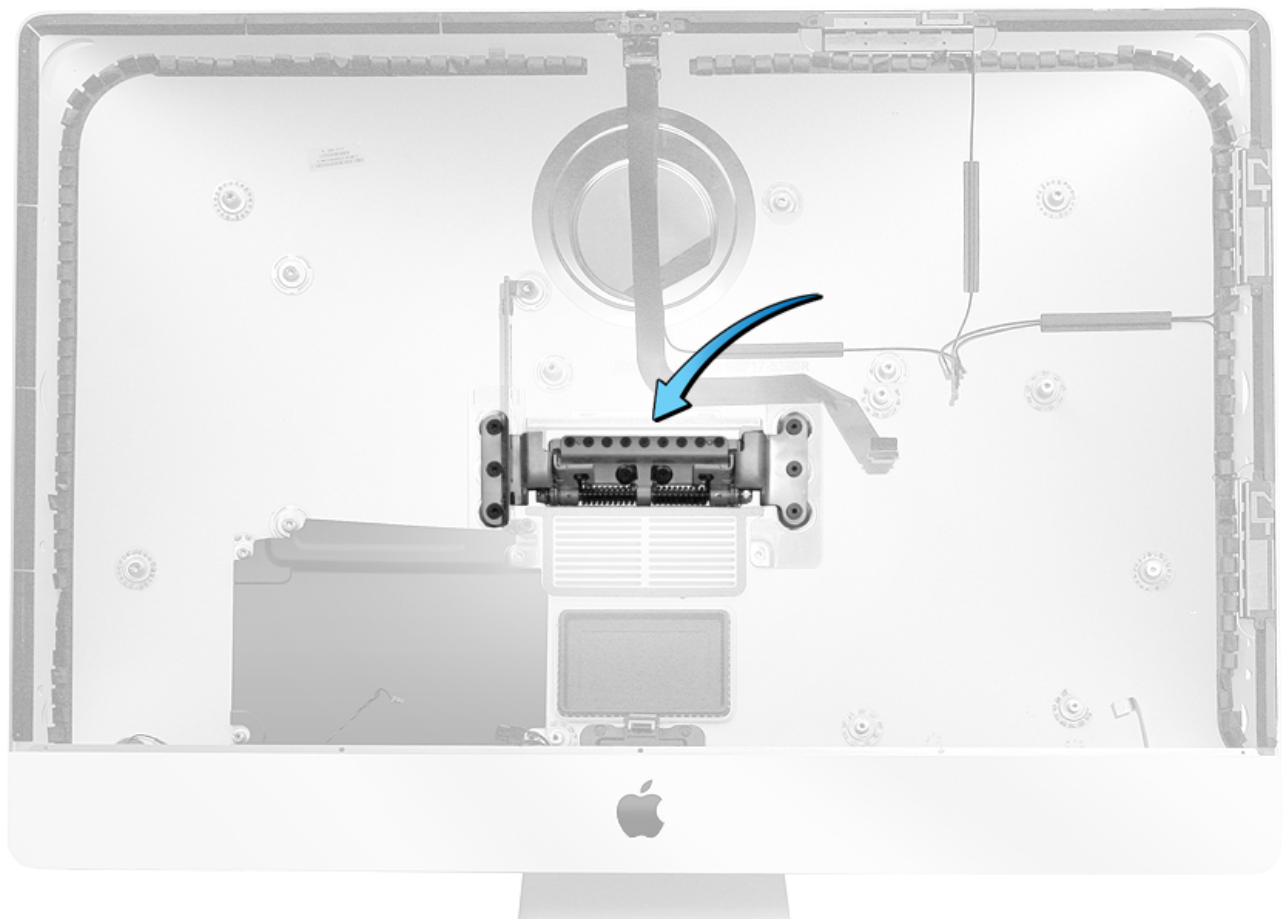
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

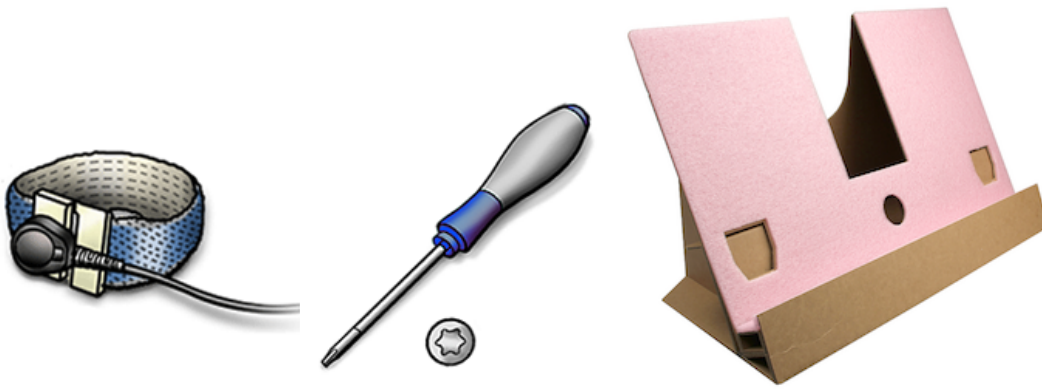
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Power supply](#)
- [Logic board](#)
- [Stand](#)



## Tools

- ESD wrist strap and mat
- Torx T10 screwdriver
- LCD service support stand (923-0416)





## Steps For Removal

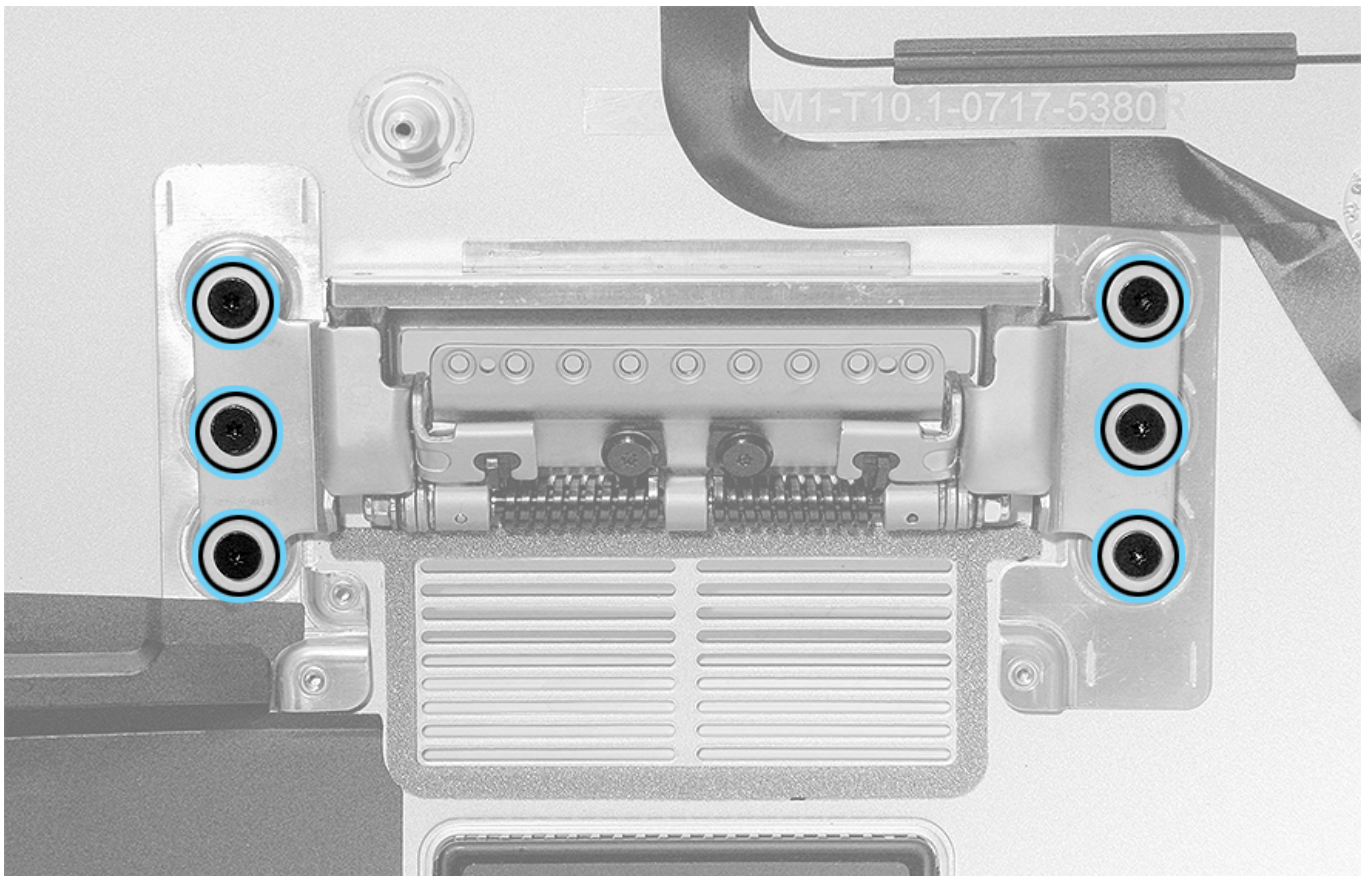
1. Place the rear housing in the LCD service support stand. Remove six (6) T10 screws:

- 923-0334 (5.8mm)



2. Lift the mechanism off of the rear housing.

**Note:** There is a different mechanism for the flash storage (SSD only) configuration (923-0376).

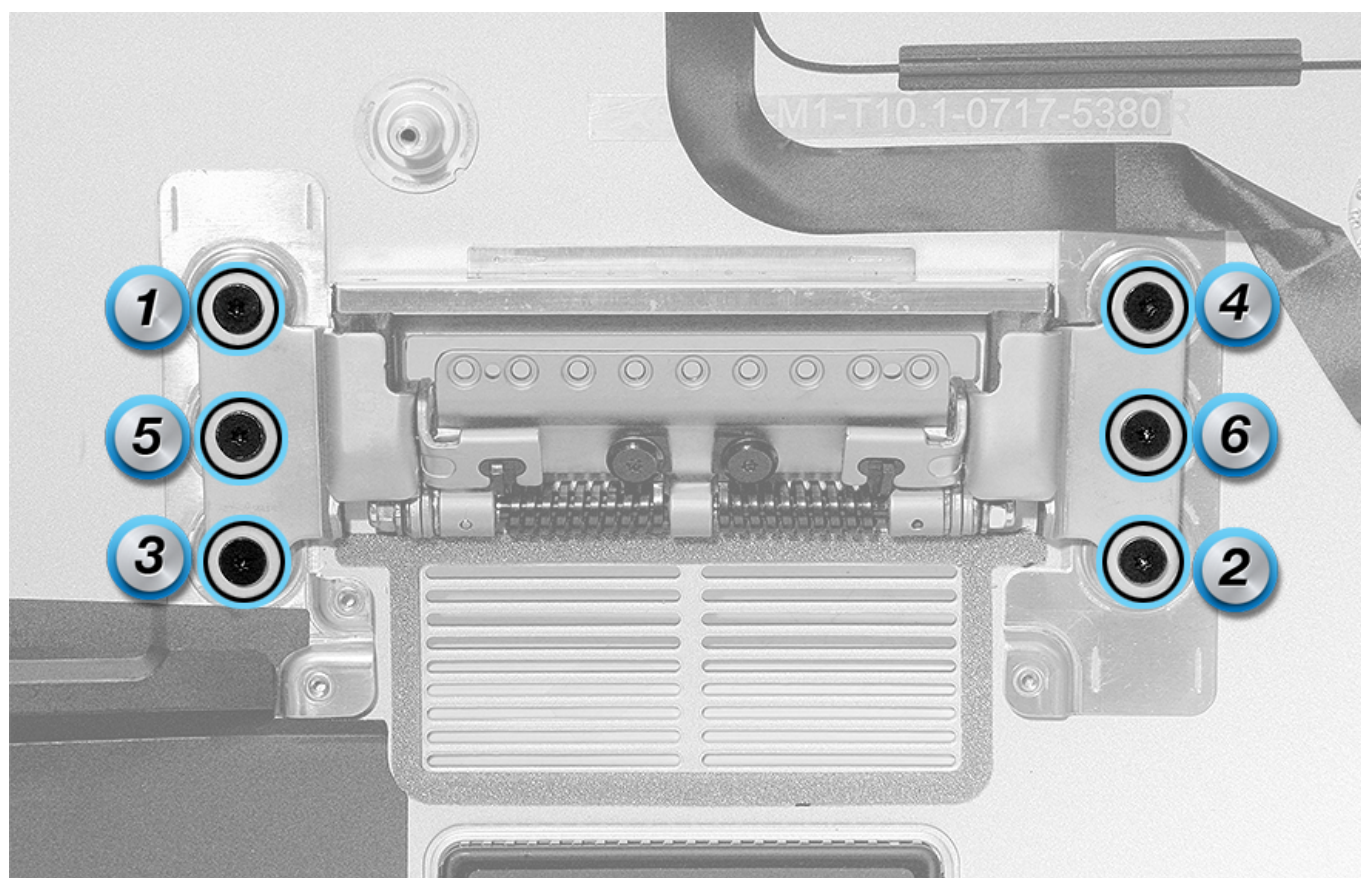


## Steps For Reassembly

1. Position the mechanism in the center of the rear housing.

2. Install six (6) T10 screws in the following order:

- 923-0334 (5.8mm)



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Rear Housing

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

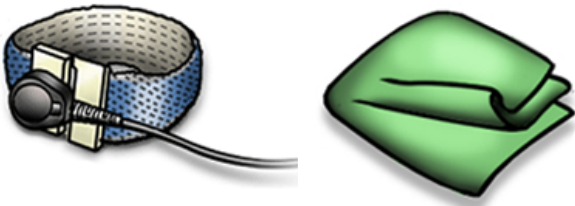
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera](#)
- [Camera/microphone cable](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Bluetooth antenna, upper](#)
- [Wi-Fi antenna, mid](#)
- [Wi-Fi antenna, lower](#)
- [Power supply](#)
- [Logic board](#)
- [Stand](#)



## Tools



- ESD wrist strap and mat
- Lint-free cloth



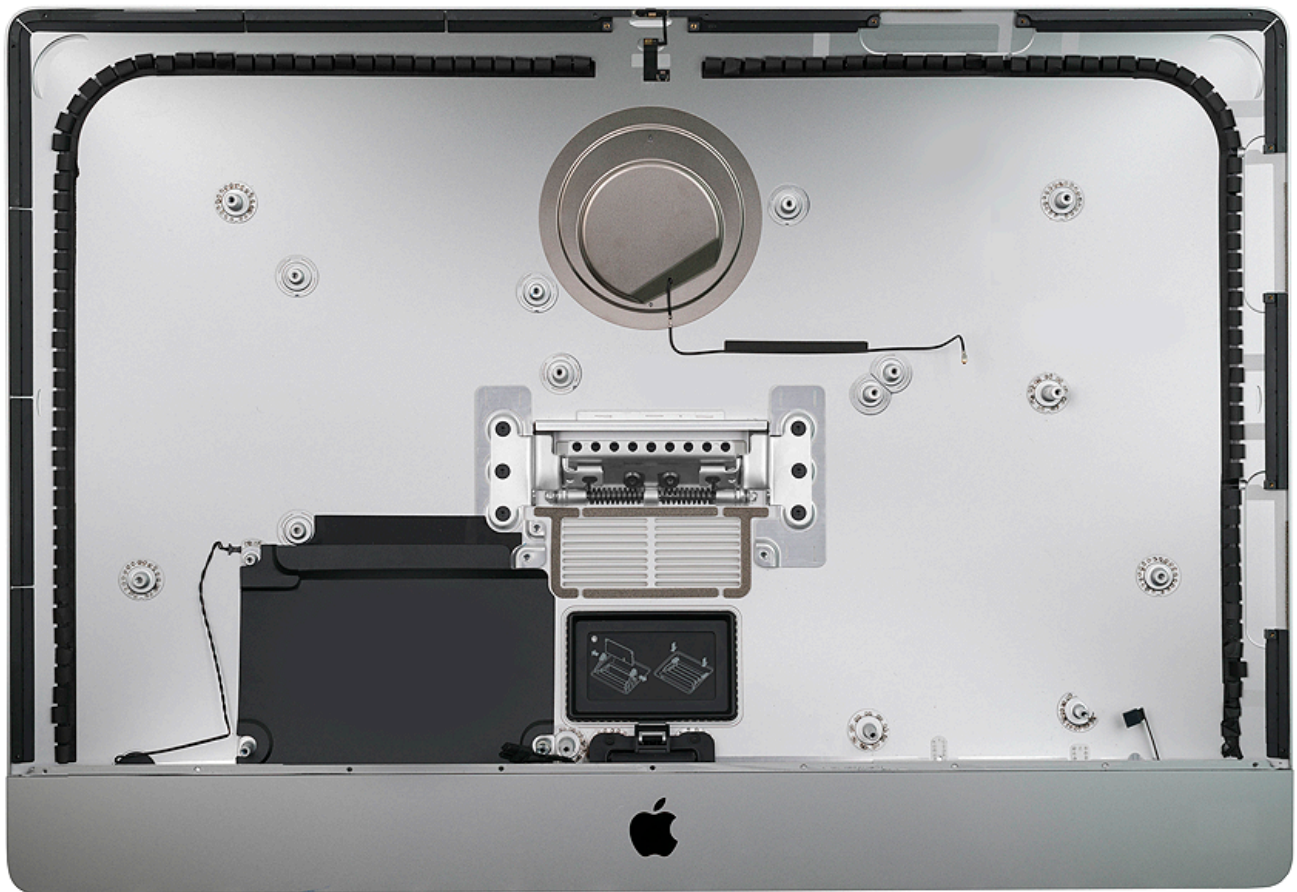
## Steps For Removal

When all other modules have been removed, the rear housing is the remaining part.

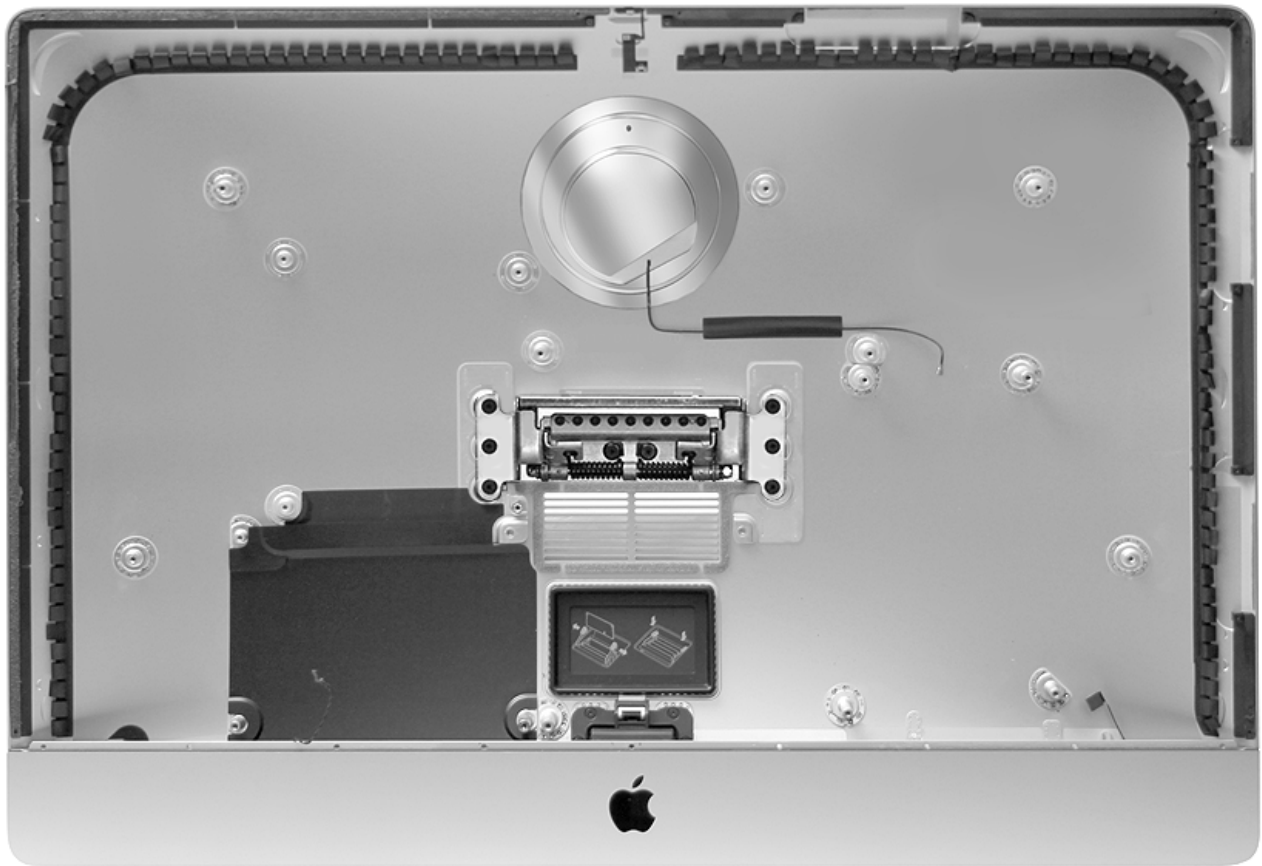
**Note:** The 9-hole rear housing (923-0522) has replaced the 5-hole rear housing (923-0378) assembly. Use the updated part in all rear housing repairs.

- iMac (Late 2012 and Late 2013) rear housing (923-0522): 9 holes on chin
- iMac (Retina 5K, 27-inch, Late 2014) rear housing (923-00081): 9 holes on chin

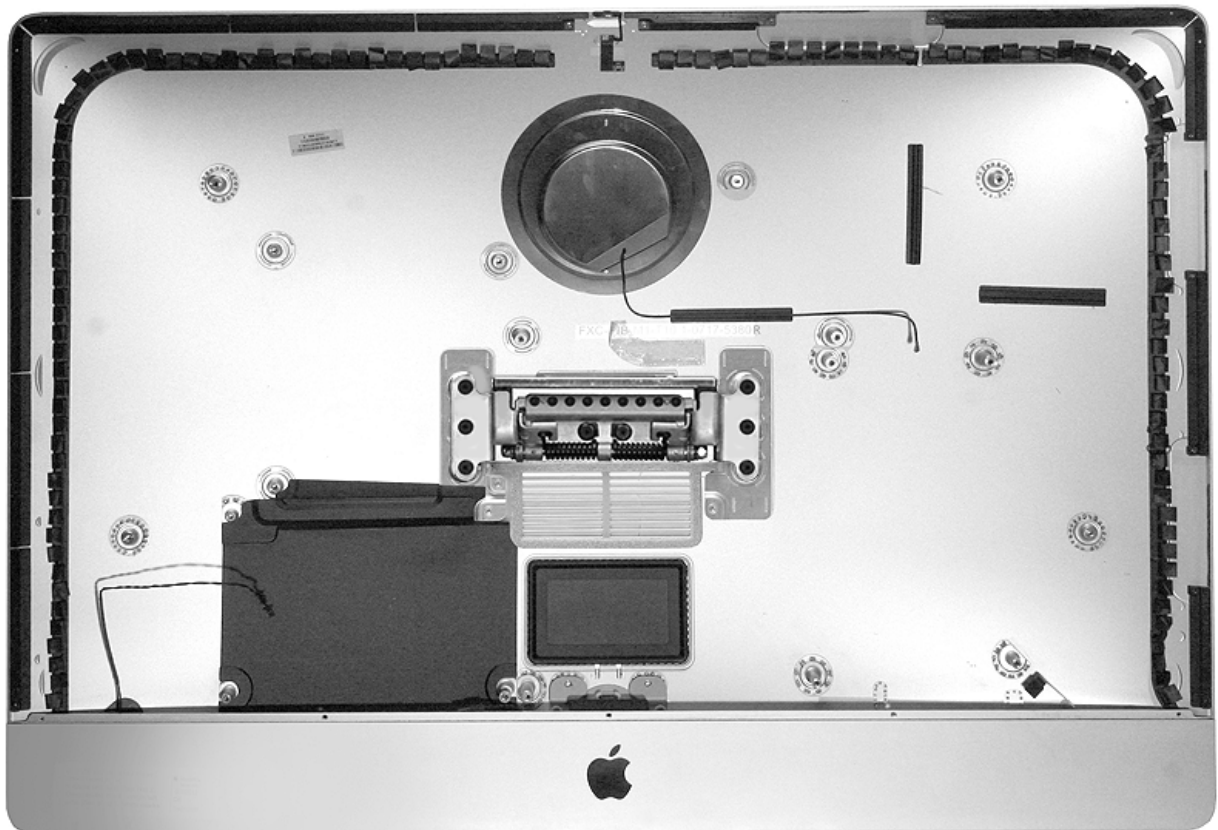
### iMac (Retina 5K, 27-inch, Late 2014)Rear Housing (923-00081)



### iMac (Late 2013)Rear Housing (923-0522)



iMac (Late 2012) Rear Housing (923-0378), with 5 holes on chin, has been replaced by 923-0522.



Depending which iMac model you are servicing, the rear housing includes the following parts, which are available separately:

- Mechanism

- Mechanism (923-0313), available only for iMac (Late 2012 and Late 2013)
- Mechanism (923-0376), available only for iMac (Late 2012 and Late 2013) units without hard drives
- Mechanism (923-00085), available only for iMac (Retina 5K, 27-inch, Late 2014)
- Mechanism screws (923-0334)
- RAM access door (923-0554)
- RAM access door lock mechanism (923-0553)
- RAM access door lock mechanism screws (923-0404)
- 9-hole chin strap (923-0528)
- Nine (9) chin strap screws (923-0338)
- T25 HDD standoff (923-0521), available only with rear housing (923-0552)
- T25 HDD standoff (923-00097), available only with iMac (Retina 5K, 27-inch, Late 2014) rear housing (923-00082)
- T25 PSU standoff (923-0520)

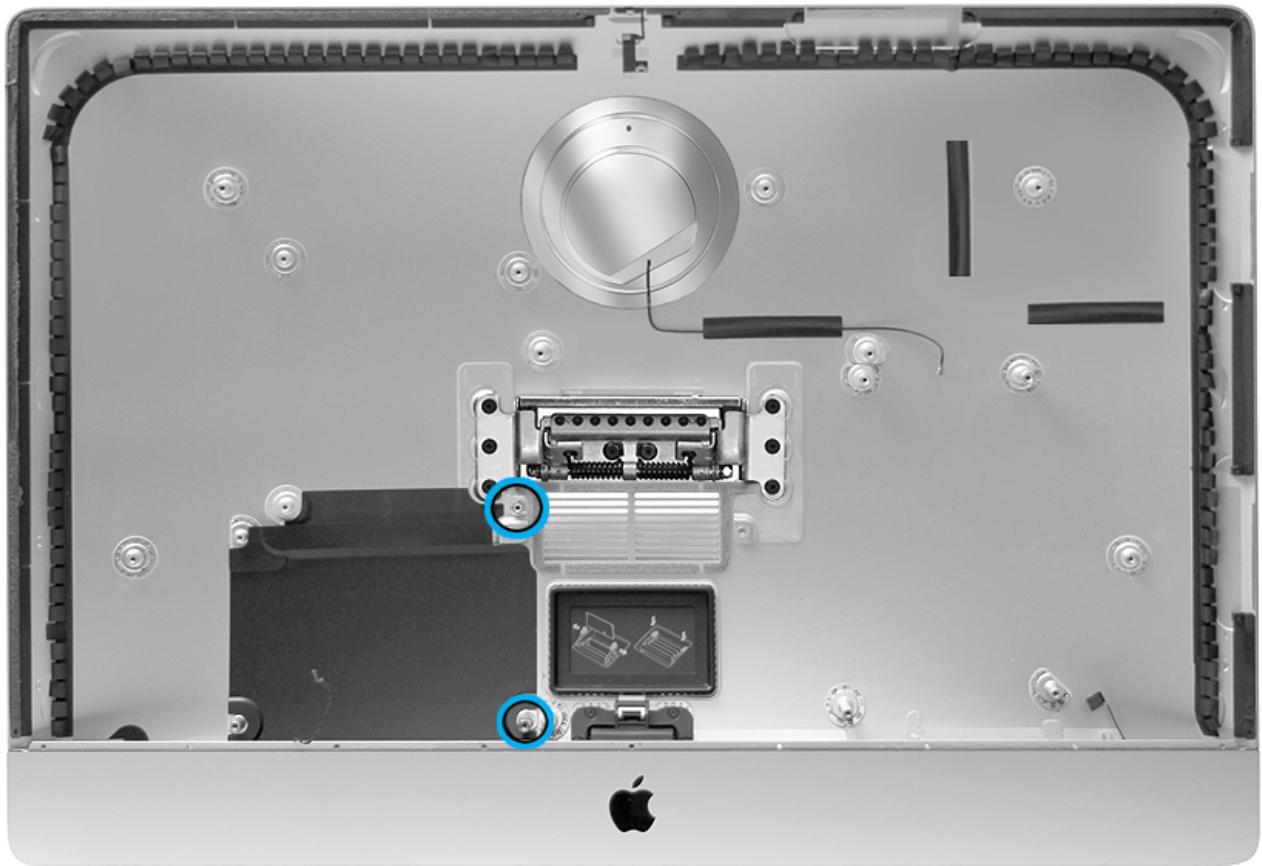
The 9-hole rear housing includes the following parts, which are **NOT** available separately:

- Wi-Fi antenna (in silver circle behind Apple logo)
- Microphone
- Power button and cable
- Audio input/output cable
- AC inlet
- Gaskets
- Wireless antenna insulator tape

## Steps For Reassembly

1. If replacing a 9-hole rear housing for the iMac (Retina 5K, 27-inch, Late 2014), proceed to step 3.
2. If replacing a 5-hole rear housing (923-0378) with a 9-hole rear housing (923-0522), do the following:
  - Transfer the RAM door from the 5-hole rear housing to the 9-hole rear housing. The RAM installation graphics on the door are specific to the Late 2012 model.
  - Install the nine (9) new chin strap screws that were included with the 9-hole replacement rear housing. Dispose of the other chin strap screws.
  - Install the new standoffs (location shown below) that were included with the 9-hole rear housing. **Note:** Do not transfer the 5-hole rear housing standoffs (923-0399 and 923-0570) to a 9-hole rear housing; they will damage the 9-hole rear housing. The two standoffs look very similar, so be sure to install each one in the correct location. The screw thread length on the hard drive standoff (923-00097) is longer than the screw thread length on the power supply standoff.

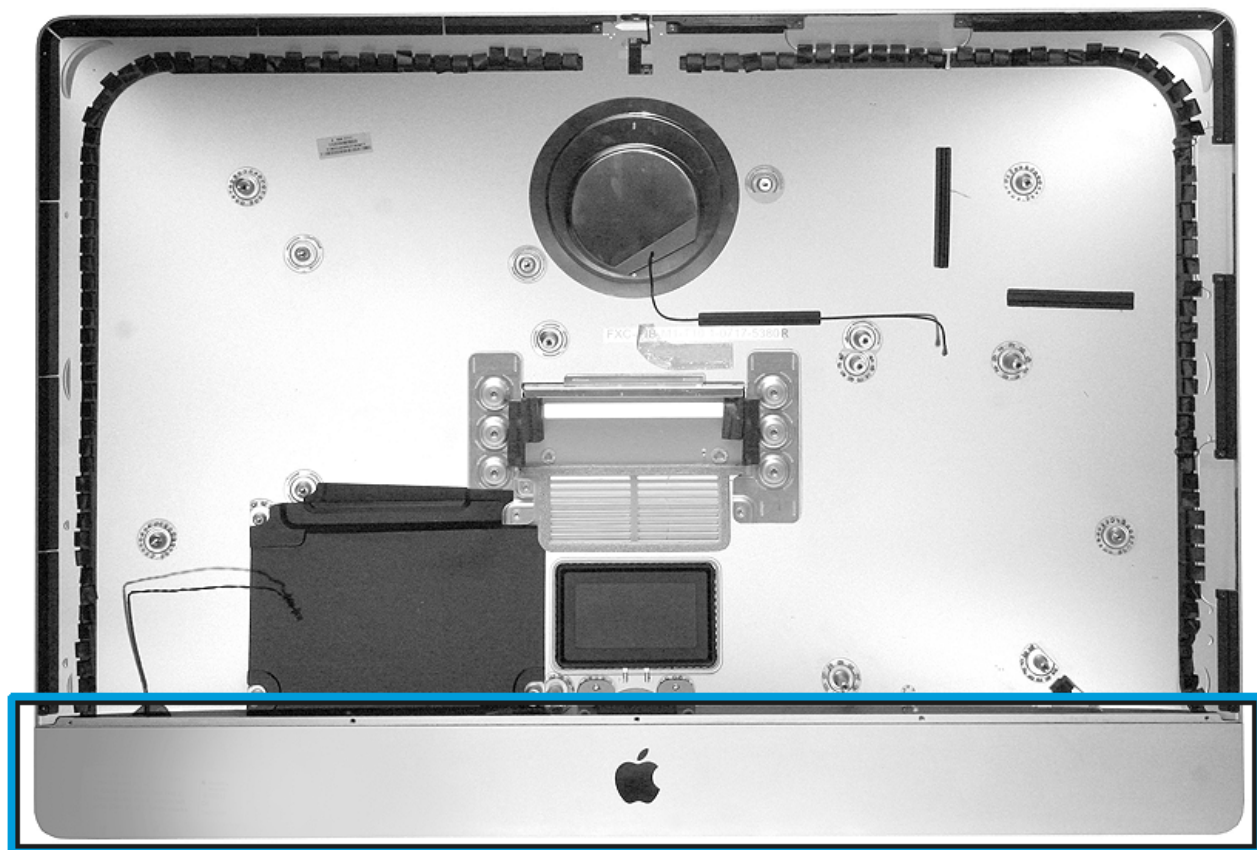




3. Transfer the hard drive brackets to the rear housing.
4. Transfer the Bluetooth antenna (upper antenna), two Wi-Fi antennas (mid and lower), and insulator tape (that secures the antennas) to the rear housing.
5. Route the antennas under the insulator tape or Mylar tape. Press the tape to secure the antennas to the rear housing.
6. Reinstall the remaining modules:
  - [Stand](#)
  - [Logic board](#)
  - [Power supply](#)
  - [Hard drive](#)
  - [Left speaker](#)
  - [Right speaker](#)
  - [Chin strap](#)
  - [Camera/microphone cable](#)
  - [Camera](#)
  - [Fan](#)
  - [Display panel VHB strips](#)
  - [Display panel](#)

### Handling the Rear Housing

**Always** handle the rear housing with two hands in the lower left and right corners. Never carry the rear housing with a single hand, or by holding the aluminum chin (where the Apple logo appears on the lower front).



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): VESA Mount Adapter

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

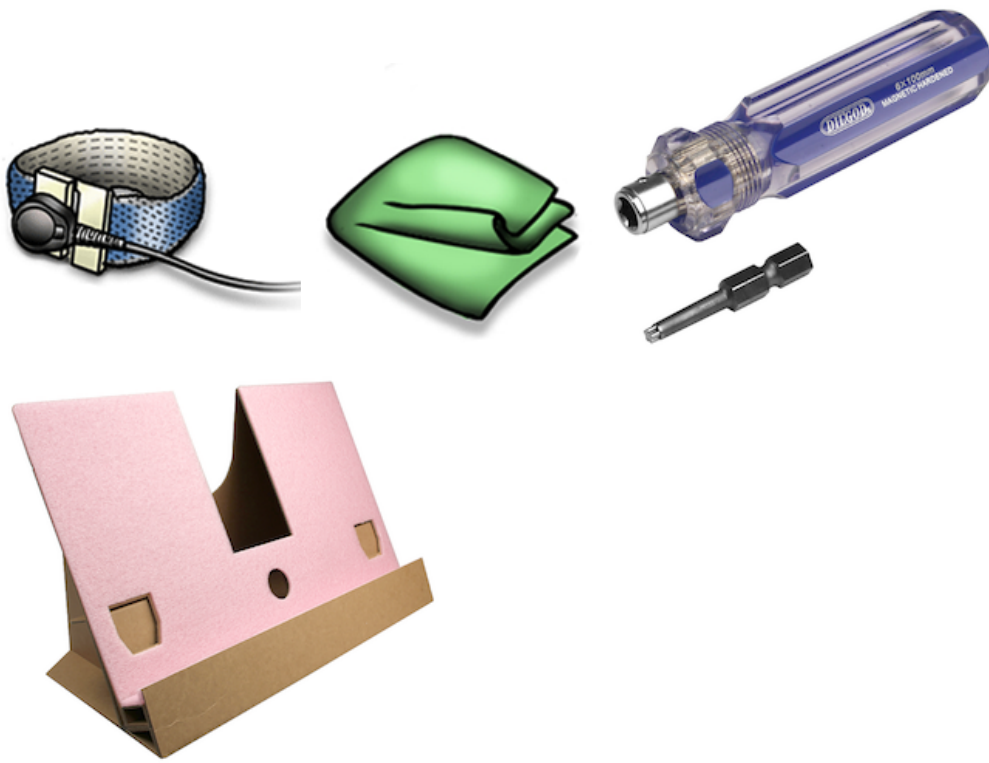
Remove:

- [Display Panel](#)
- [Display Panel VHB Strips](#)
- [Fan](#)
- [Disconnect Camera Cable from Logic Board](#)
- [Chin Strap](#)
- [Right Speaker](#)
- [Left Speaker](#)
- [Hard Drive](#)
- [Disconnect Bluetooth Antenna, Upper](#)
- [Disconnect Wi-Fi Antenna, Mid](#)
- [Disconnect Wi-Fi Antenna, Lower](#)
- [Power Supply](#)
- [Logic Board](#)



## Tools

- ESD wrist strap and mat
- Lint-free cloth
- VESA Pentalobe driver (923-0367)
- LCD Service Support Stand (923-0416)

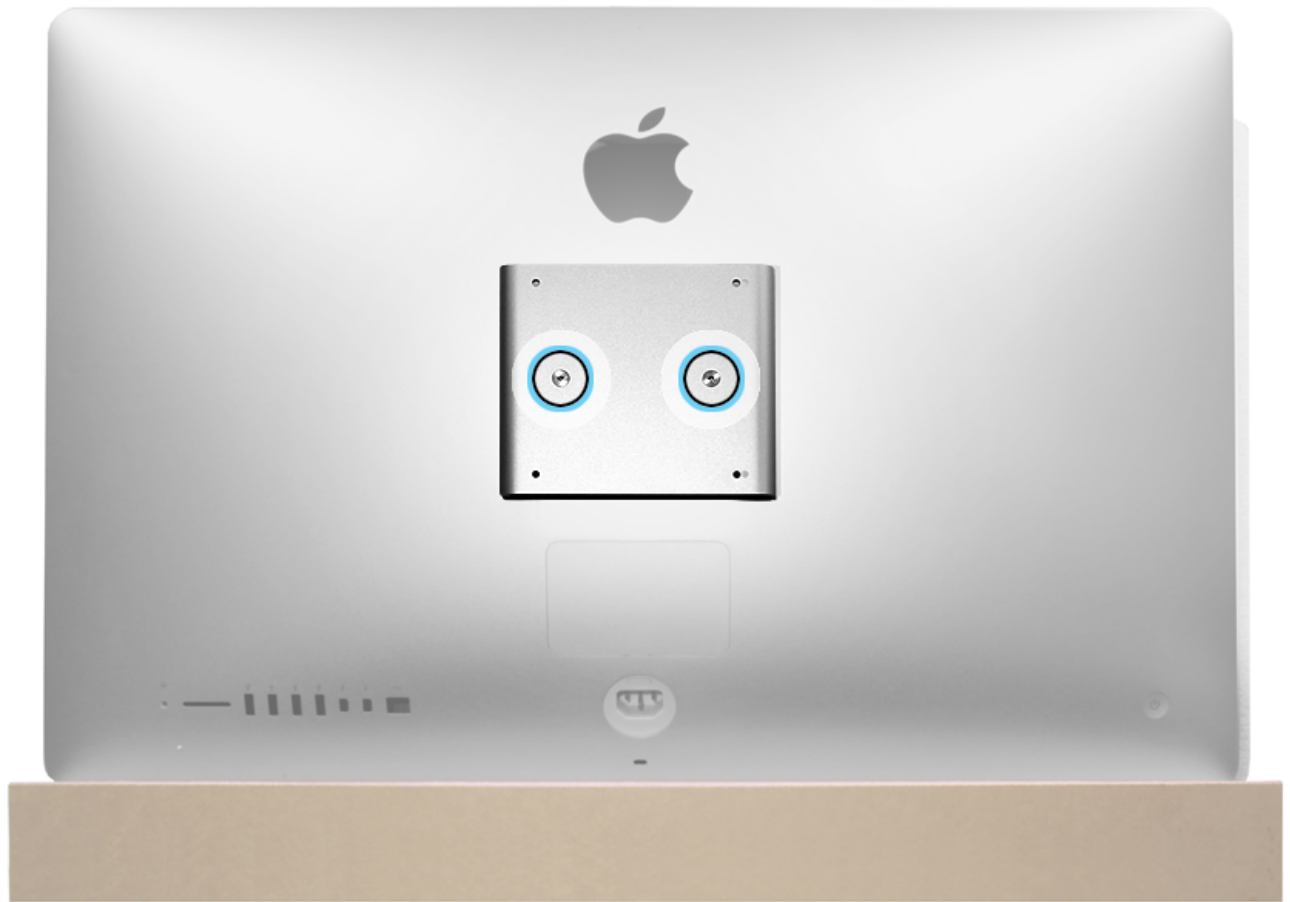


### Steps For Removal

1. Place rear housing on LCD support stand, with VESA mount adapter facing you.
2. Remove two (2) pentalobe screws.
  - 923-0418

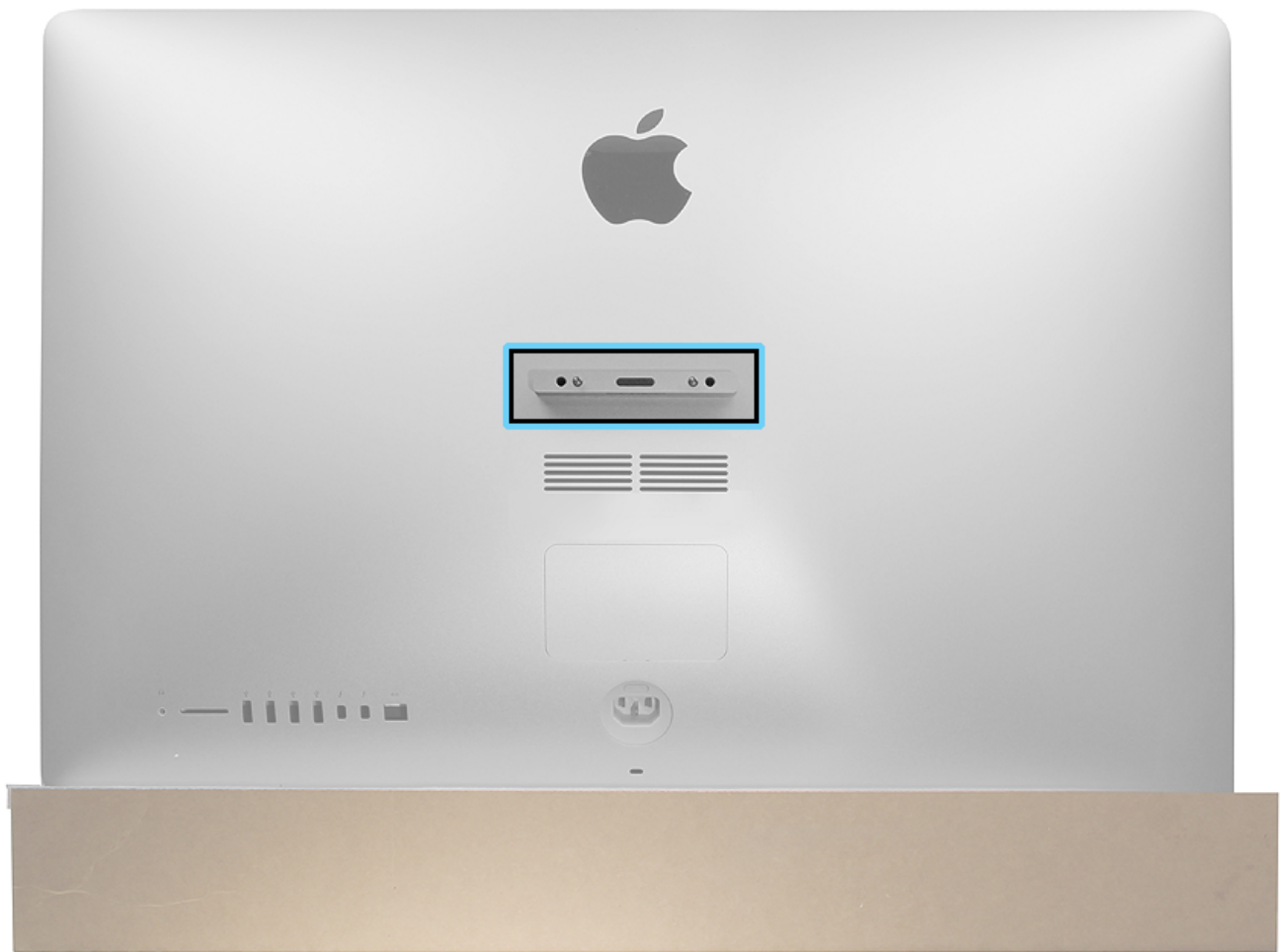


3. Lift VESA mount adapter off rear housing.



### Steps For Reassembly

1. Insert VESA tongue into opening on rear housing (if removed).



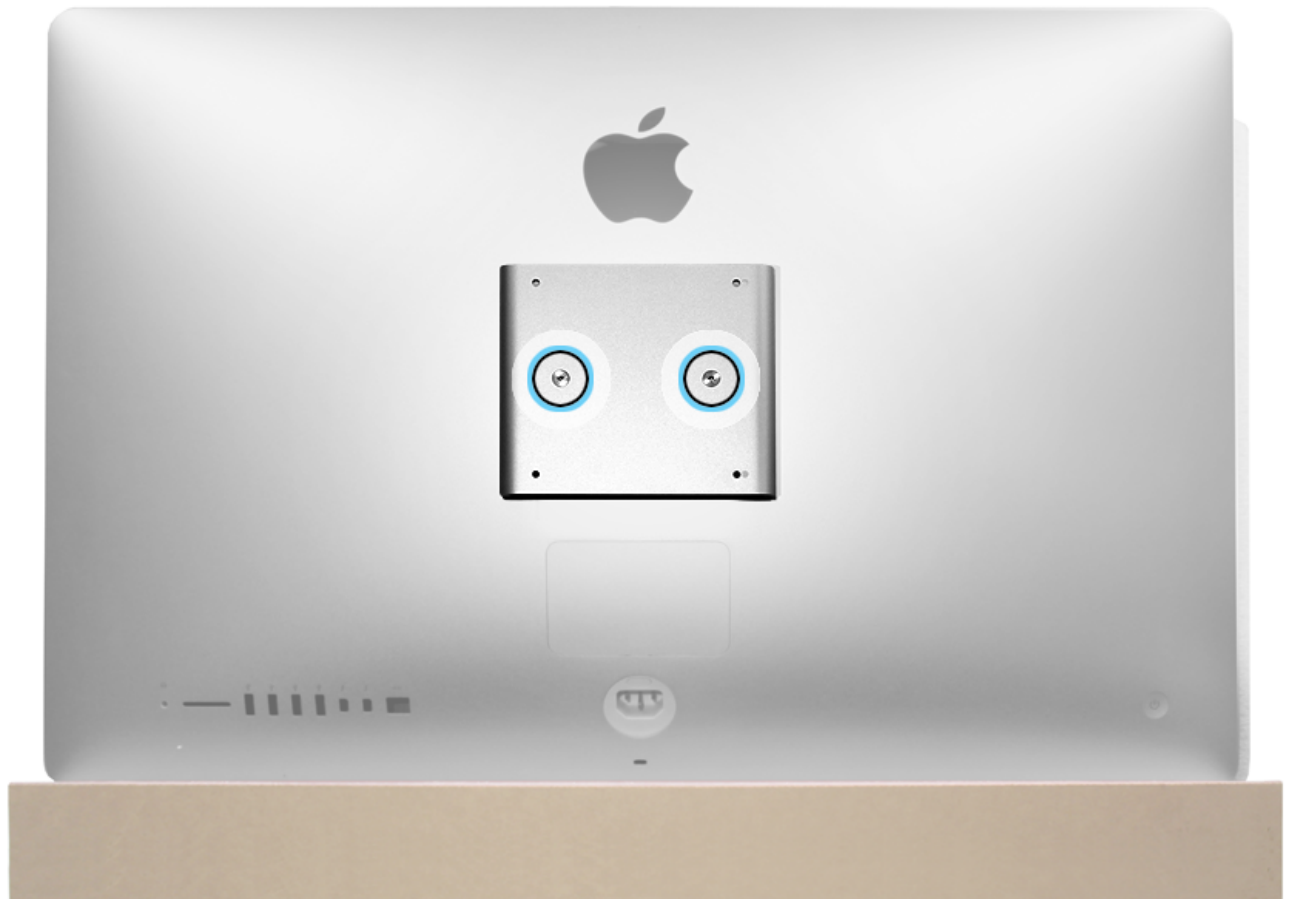
2. Place VESA mount adapter over VESA tongue, lining up screw holes.

3. Install two (2) pentalobe screws.

- 923-0418







4. Replace [Logic Board](#).
5. Replace [Power Supply](#).
6. Connect [Wi-Fi Antenna, Lower](#).
7. Connect [Wi-Fi Antenna, Mid](#).
8. Connect [Bluetooth Antenna, Upper](#).
9. Replace [Hard Drive](#).
10. Replace [Left Speaker](#).
11. Replace [Right Speaker](#).
12. Replace [Chin Strap](#).
13. Connect [Camera Cable](#) to Logic board.
14. Replace [Fan](#).
15. Replace [Display Panel VHB Strips](#).
16. Replace [Display Panel](#).

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): VESA Tongue

## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

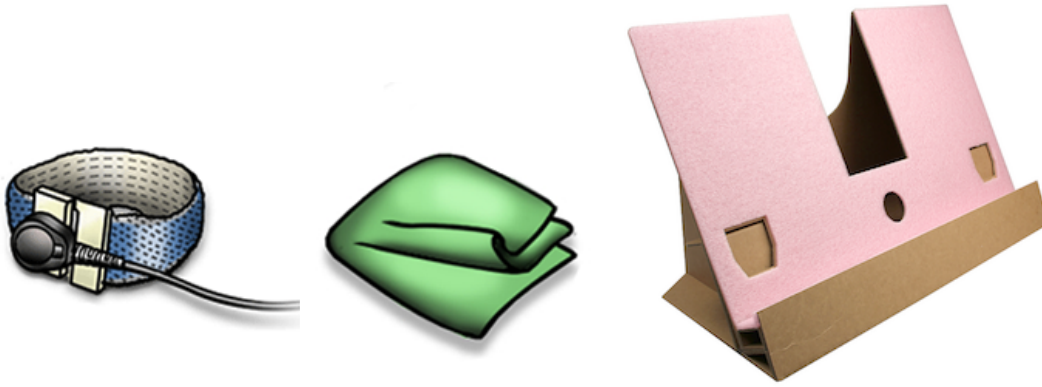
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Disconnect camera cable from logic board](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Disconnect Bluetooth antenna, upper](#)
- [Disconnect Wi-Fi antenna, mid](#)
- [Disconnect Wi-Fi antenna, lower](#)
- [Power supply](#)
- [Logic board](#)
- [VESA mount adapter](#)



## Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD Service Support Stand (923-0416)

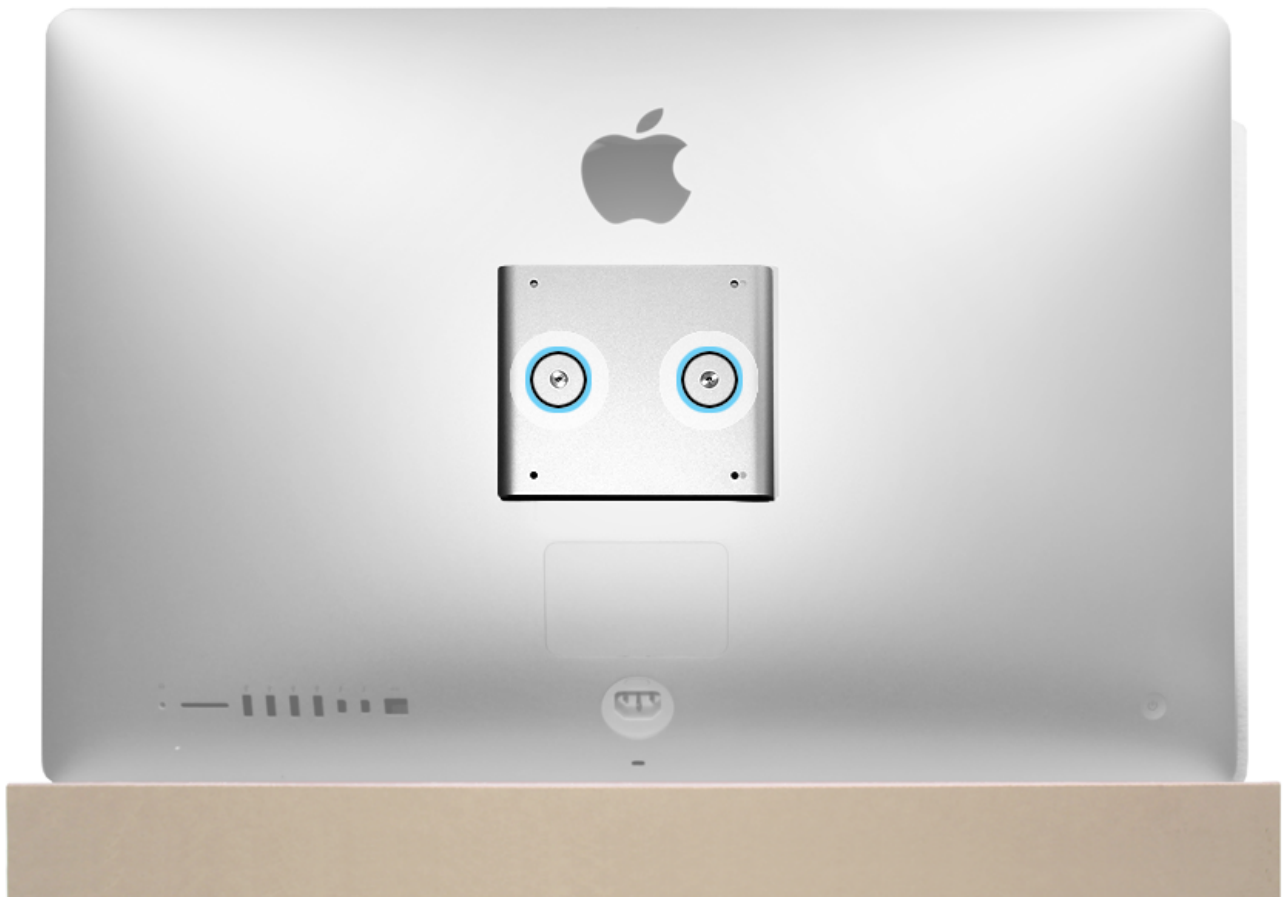


## Steps For Removal

1. Place the rear housing on the LCD support stand, with the VESA mount adapter facing you.
2. Remove two (2) pentalobe screws (923-0418).



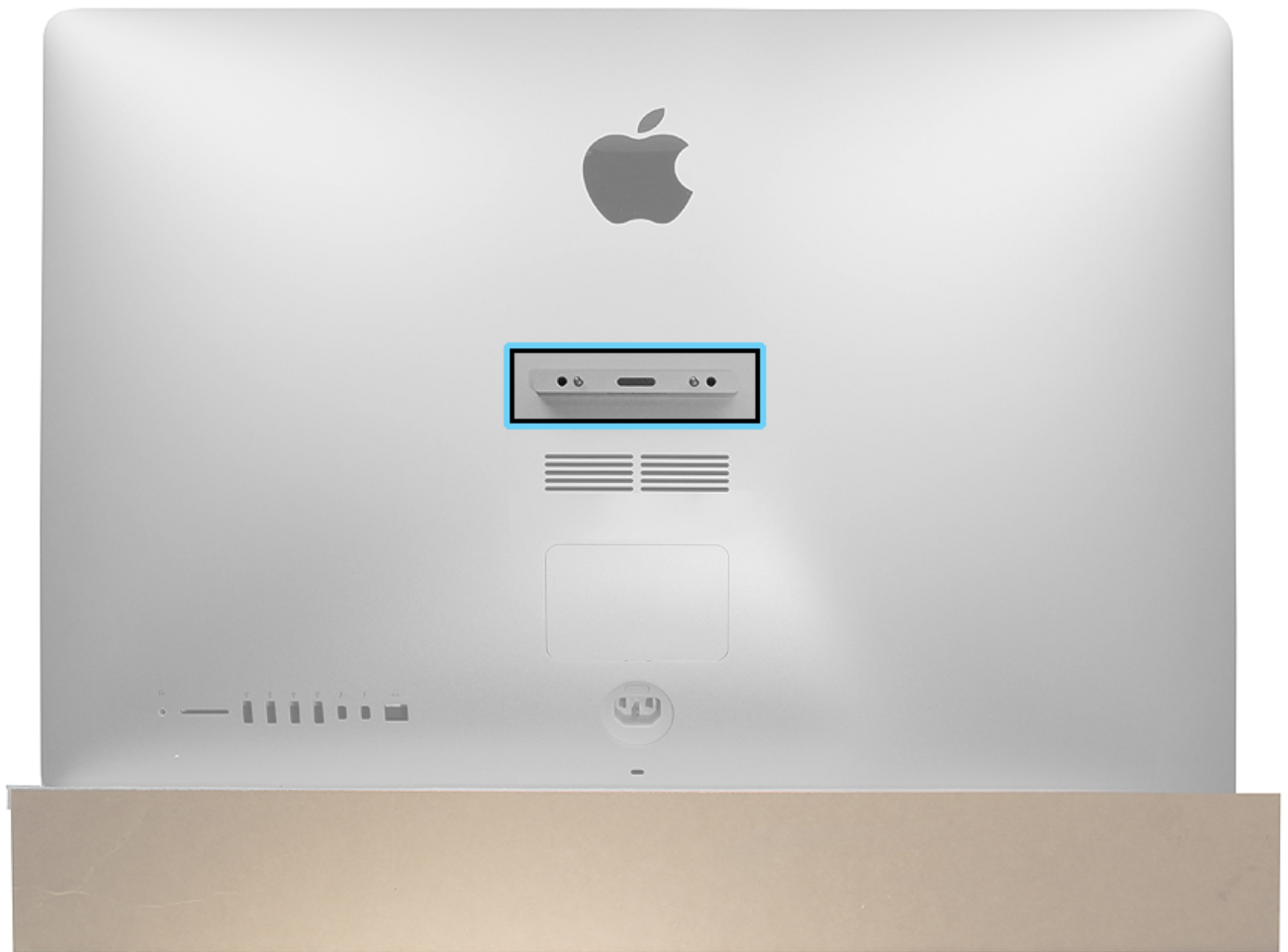
3. Lift the VESA mount adapter off the rear housing.



## Steps For Reassembly

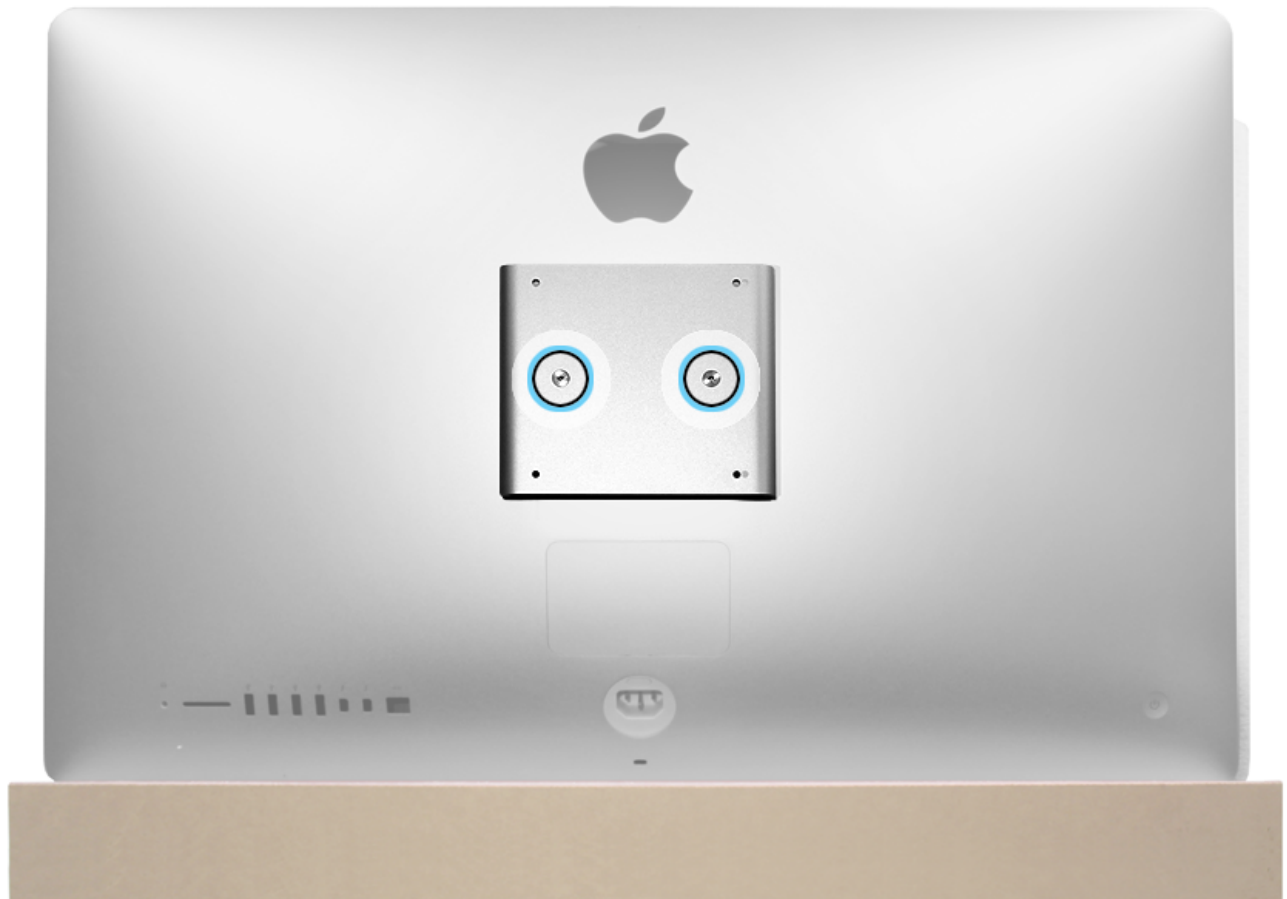
1. Place the VESA mount adapter on top of the VESA tongue, lining up screw holes. **Note:** The computer serial number is on

the underside of the tongue.



2. Reinstall two (2) pentalobe screws (923-0418).





3. Replace the [VESA mount adapter](#).
4. Replace the [logic board](#).
5. Replace the [power supply](#).
6. Connect the [Wi-Fi antenna, lower](#).
7. Connect the [Wi-Fi antenna, mid](#).
8. Connect the [Bluetooth antenna, upper](#).
9. Replace the [hard drive](#).
10. Replace the [left speaker](#).
11. Replace the [right speaker](#).
12. Replace the [chin strap](#).
13. Connect the [camera cable](#) to the logic board.
14. Replace the [fan](#).
15. Install new [display panel VHB strips](#).
16. Replace the [display panel](#).



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): VESA Mechanism Plate

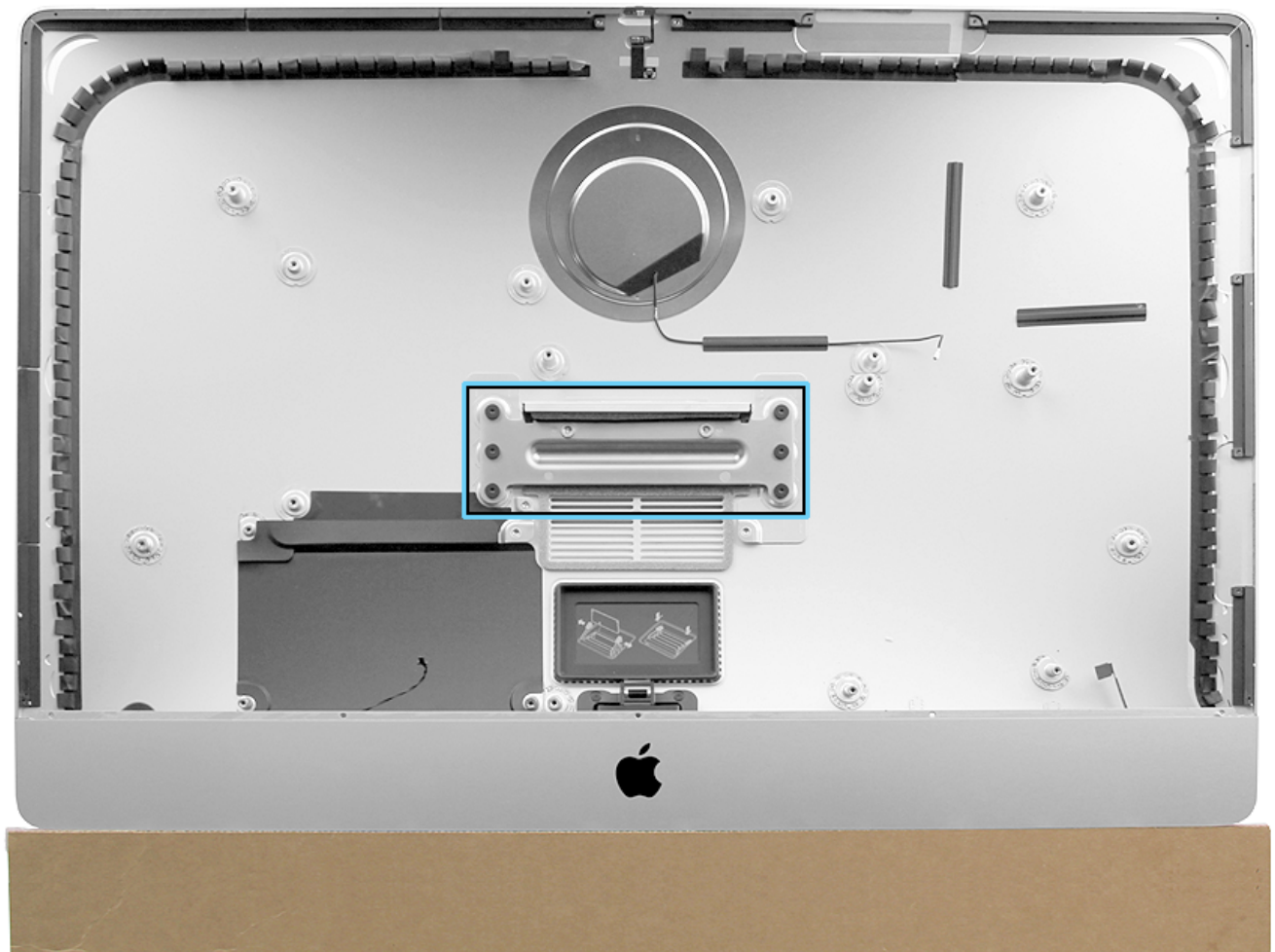
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\), iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

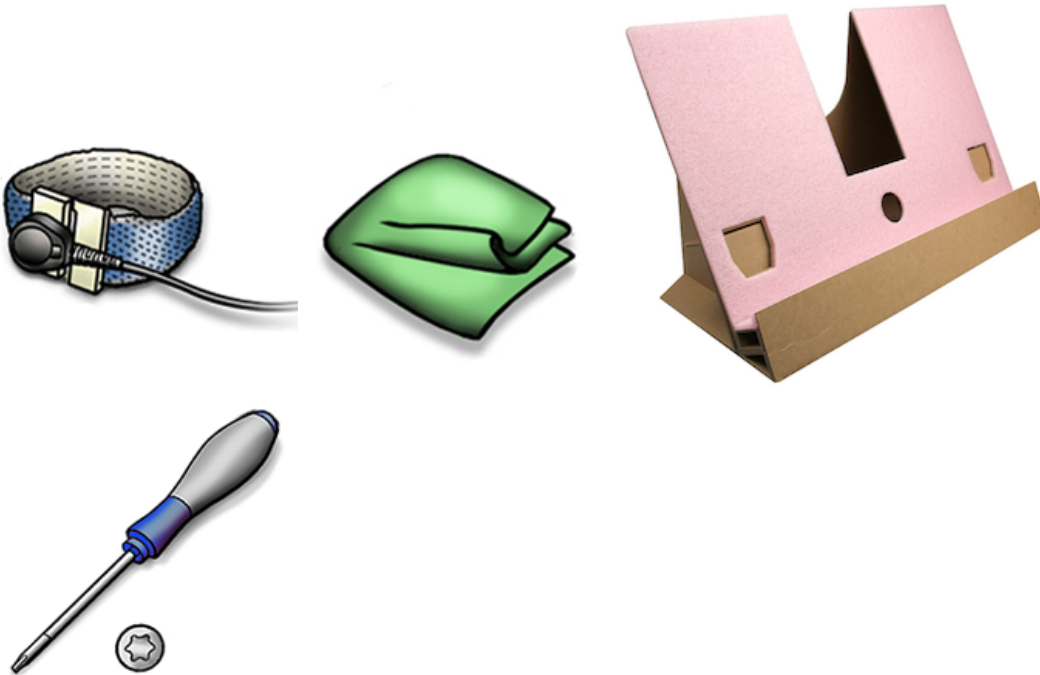
Remove:

- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera cable \(disconnect from logic board\)](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Bluetooth antenna \(upper\)](#)
- [Wi-Fi antenna \(mid\)](#)
- [Wi-Fi antenna \(lower\)](#)
- [Power supply](#)
- [Logic board](#)
- [VESA mount adapter](#)
- [VESA tongue](#)



## Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD service support stand (923-0416)
- Torx T10 screwdriver

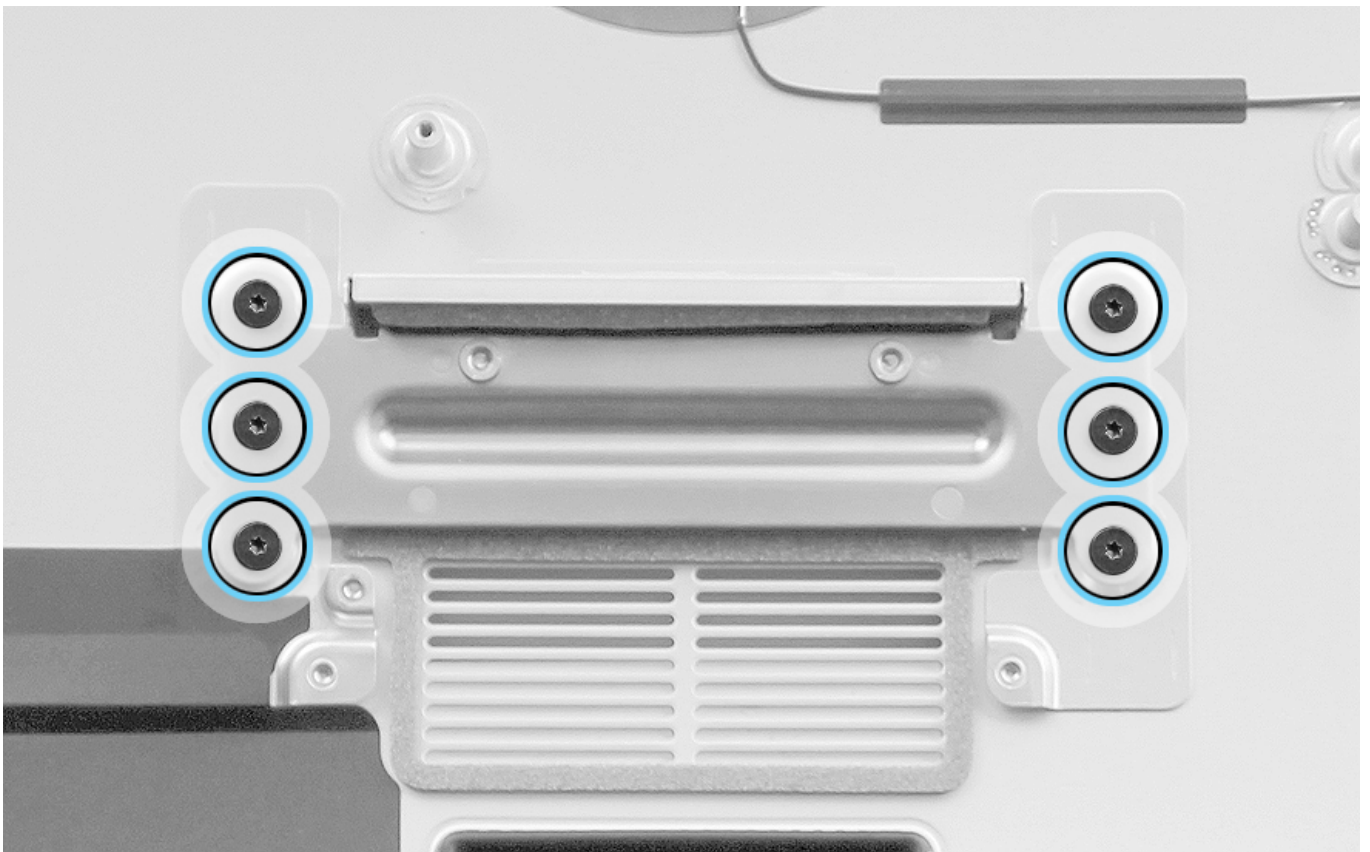


### Steps For Removal

1. Place the rear housing on the LCD support stand, with the VESA mechanism plate facing you.
2. Remove six (6) T10 screws.
  - 923-0334



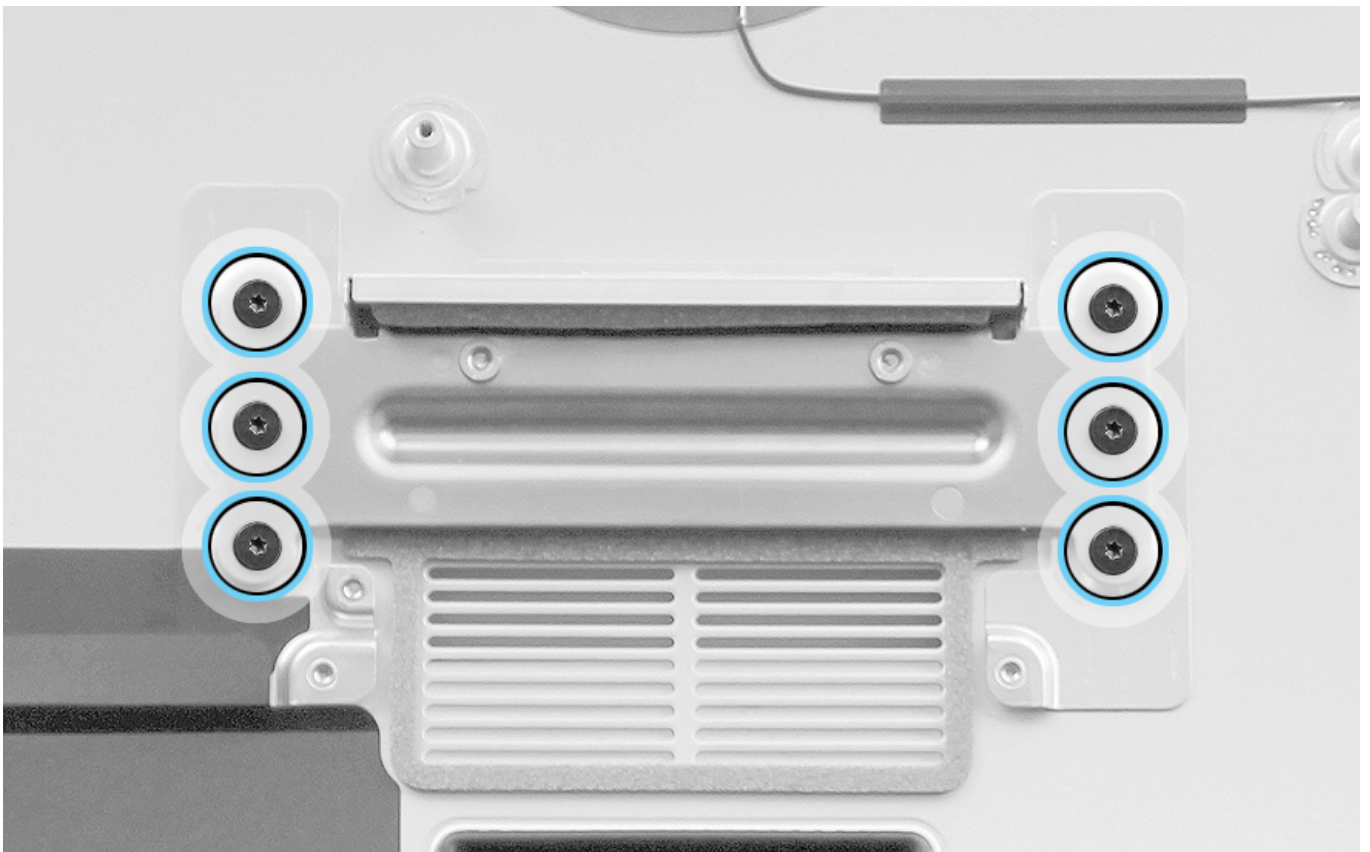
3. Lift the VESA mechanism plate off of the rear housing.



### Steps For Reassembly

1. Position the mechanism plate in the rear housing.
2. Reinstall the six (6) T10 screws.
  - 923-0334





3. Reinstall the [VESA tongue](#).
4. Reinstall the [VESA mount adapter](#).
5. Reinstall the [logic board](#).
6. Reinstall the [power supply](#).
7. Connect the [Wi-Fi antenna \(lower\)](#).
8. Connect the [Wi-Fi antenna \(mid\)](#).
9. Connect the [Bluetooth antenna \(upper\)](#).
10. Reinstall the [hard drive](#).
11. Reinstall the [left speaker](#).
12. Reinstall the [right speaker](#).
13. Reinstall the [chin strap](#).
14. Connect the [camera cable](#) to the logic board.
15. Reinstall the [fan](#).
16. Install new [display panel VHB strips](#).
17. Reinstall the [display panel](#).



# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): VESA Rear Housing

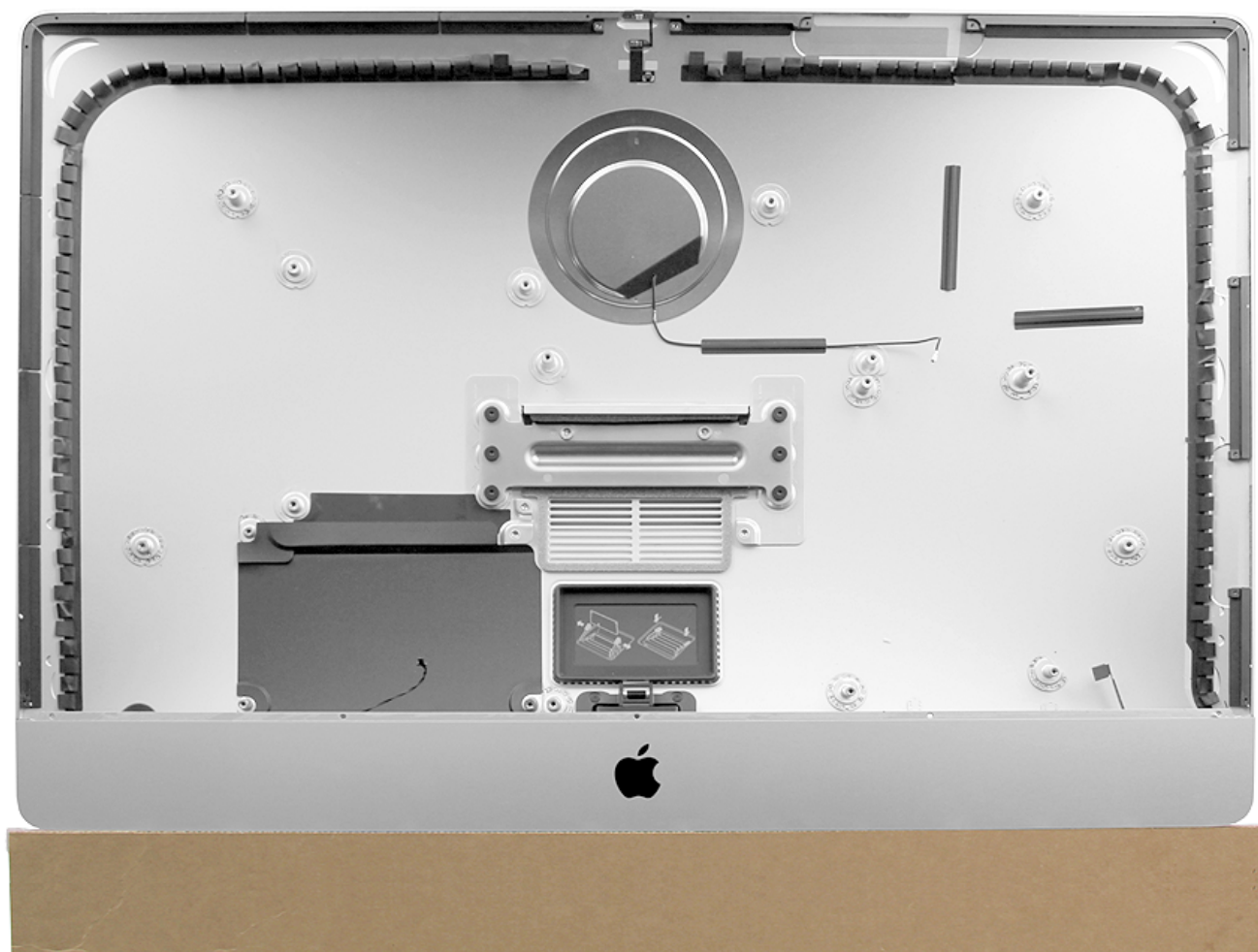
## First Steps

Before attempting this procedure, technicians must pass a qualification exam in addition to the ACMT certification. For more information, refer to Apple Support article [TP970: Becoming Qualified for iMac \(21.5-inch, Late 2012, Early 2013, Late 2013, Mid 2014\) and iMac \(27-inch, Late 2012 and Late 2013\), and iMac \(Retina 5K, 27-inch, Late 2014\) Repairs](#).

Before you begin:

Remove:

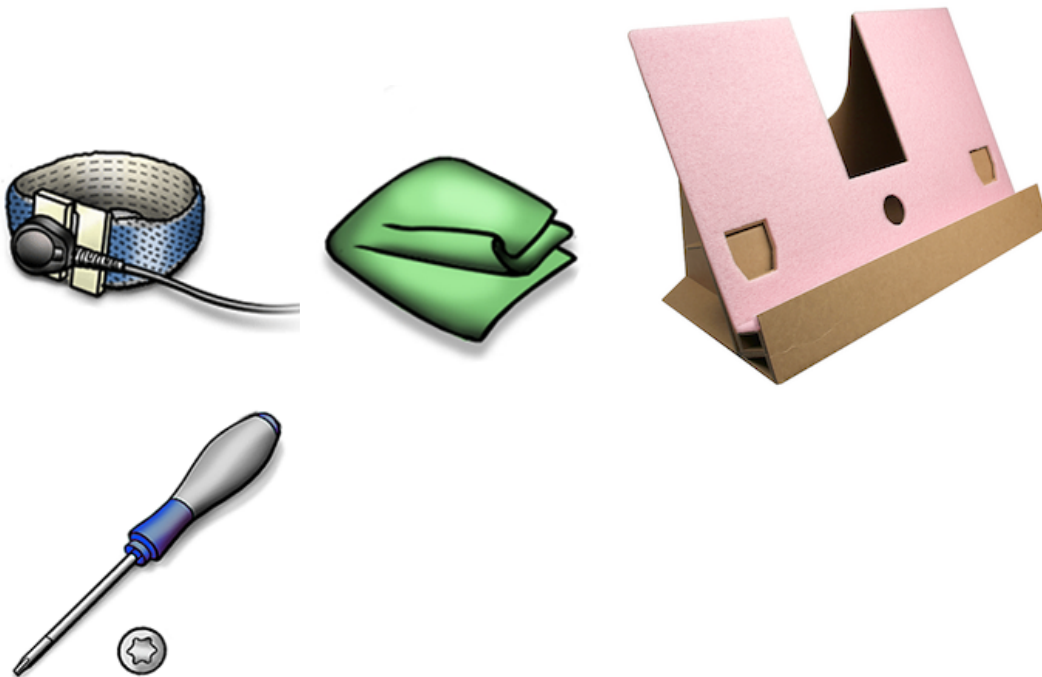
- [Display panel](#)
- [Display panel VHB strips](#)
- [Fan](#)
- [Camera](#)
- [Camera/microphone cable](#)
- [Chin strap](#)
- [Right speaker](#)
- [Left speaker](#)
- [Hard drive](#)
- [Bluetooth antenna, upper](#)
- [Wi-Fi antenna, mid](#)
- [Wi-Fi antenna, lower](#)
- [Power supply](#)
- [Logic board](#)
- [VESA mount adapter](#)
- [VESA tongue](#)





## Tools

- ESD wrist strap and mat
- Lint-free cloth
- LCD service support stand (923-0416)
- Torx T10 screwdriver
- Torx T8 screwdriver
- Torx T4 screwdriver



## Steps For Removal

1. Place the computer on the LCD service support stand to remove all modules listed above.
2. With all modules removed, the rear housing is the remaining part.
  - 923-0552: VESA rear housing for Late 2012 and Late 2013 models. **Note:** The original VESA rear housing 923-0426, which has five (5) screw holes on the chin (see below), was replaced by VESA rear housing (923-0552), which has nine (9) screw holes on the chin.
  - 923-00082: VESA rear housing for iMac (Retina 5K, 27-inch, Late 2014)

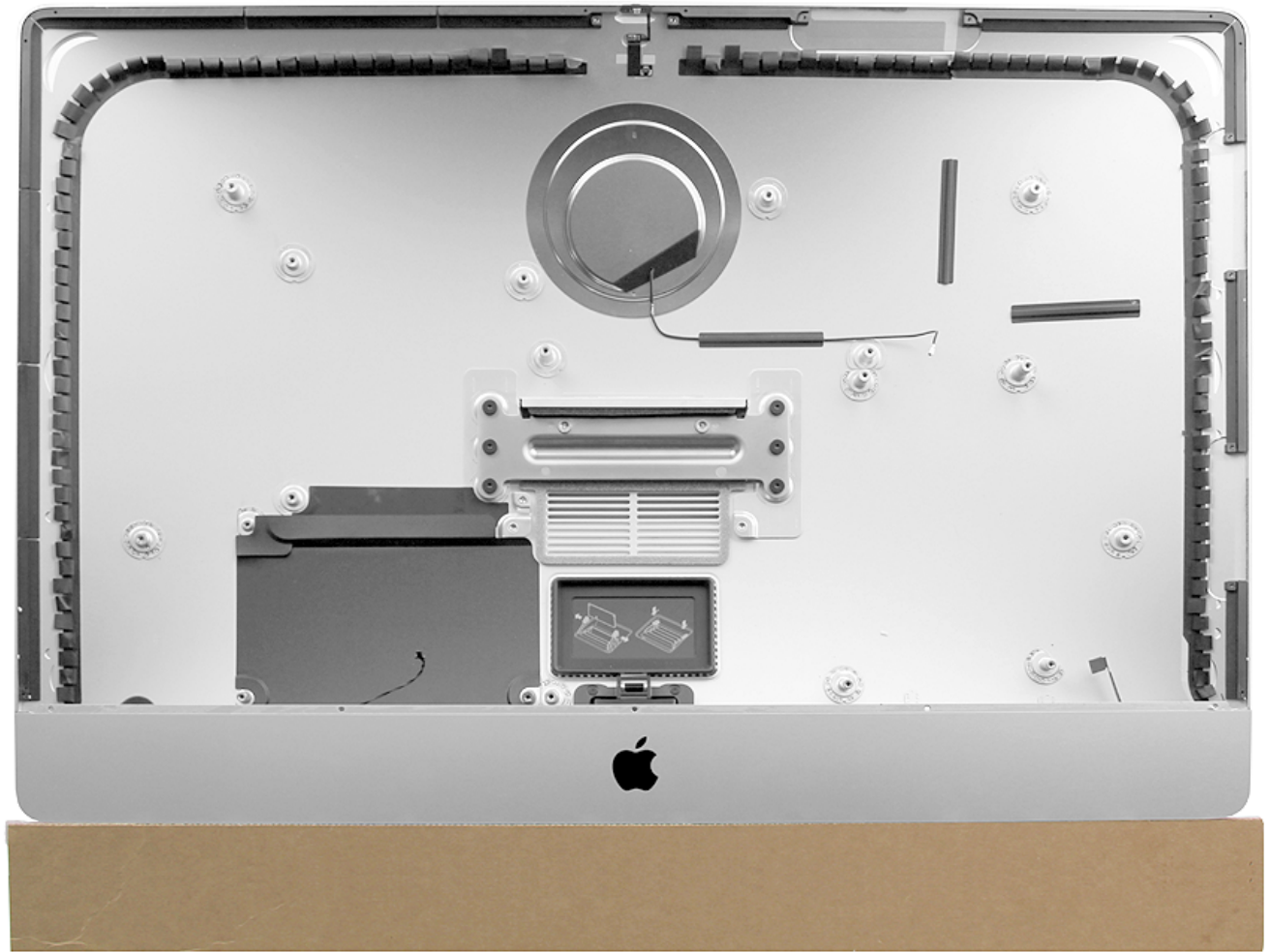
A VESA rear housing includes the following parts, which are **not** available separately:

- Wi-Fi antenna in silver circle behind Apple logo
- microphone
- power button and cable
- AC inlet
- audio input/output cable
- gaskets
- wireless antenna insulators

A VESA rear housing includes the following parts, which are available separately:

- RAM access door (923-0554)
- RAM access door lock mechanism (923-0553)
- RAM access door lock mechanism screws (923-0404)
- VESA mechanism plate (923-0532)
- VESA mechanism plate screws (923-0334)
- VESA screws (923-0418)
- 9-hole chin strap (923-0528)
- 9 chin strap screws (923-0338)
- T25 PSU standoff (923-0520), use only with 9-hole chin strap / rear housing (923-0552)
- T25 HDD standoff (923-0521), use only with 9-hole chin strap / rear housing (923-0552)
- T25 HDD standoff (923-00097), available only with iMac (Retina 5K, 27-inch, Late 2014) rear housing (923-00082)

**Original VESA Rear Housing (923-0426 - 5 holes for chin strap)**



## Steps For Reassembly

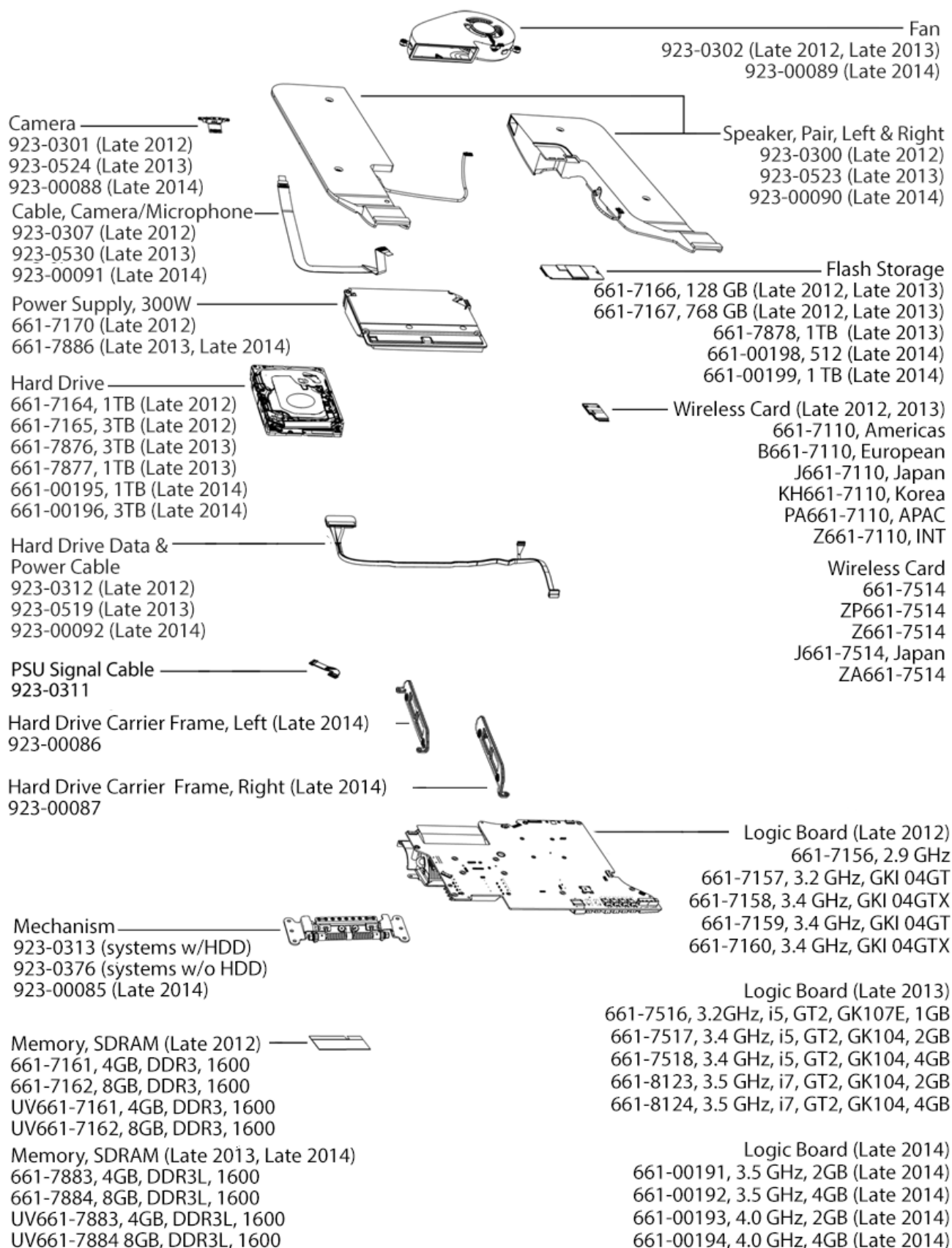
**Caution:** Always handle the rear housing with two hands in the lower left and right corners. Handling the rear housing incorrectly could flex the aluminum and cause alignment issues. Never carry the rear housing with a single hand and do not push in or pull out on the chin.

1. Transfer the Bluetooth and Wi-Fi antennas to the rear housing.
2. Press the Mylar tape on the Bluetooth and Wi-Fi antennas onto the rear housing.
3. Transfer the hard drive brackets.
4. Transfer the VESA mount adapter and VESA tongue.
5. Replace the [logic board](#).
6. Replace the [power supply](#).
7. Connect the [Wi-Fi antenna \(lower\)](#).
8. Connect the [Wi-Fi antenna \(mid\)](#).
9. Connect the [Bluetooth antenna \(upper\)](#).
10. Replace the [hard drive](#).
11. Replace the [left speaker](#).
12. Replace the [right speaker](#).
13. Replace the [chin strap](#).
14. Connect the [camera cable](#) to the logic board.
15. Replace the [fan](#).
16. Install new [display panel VHB strips](#).
17. Replace the [display panel](#).

# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Exploded View

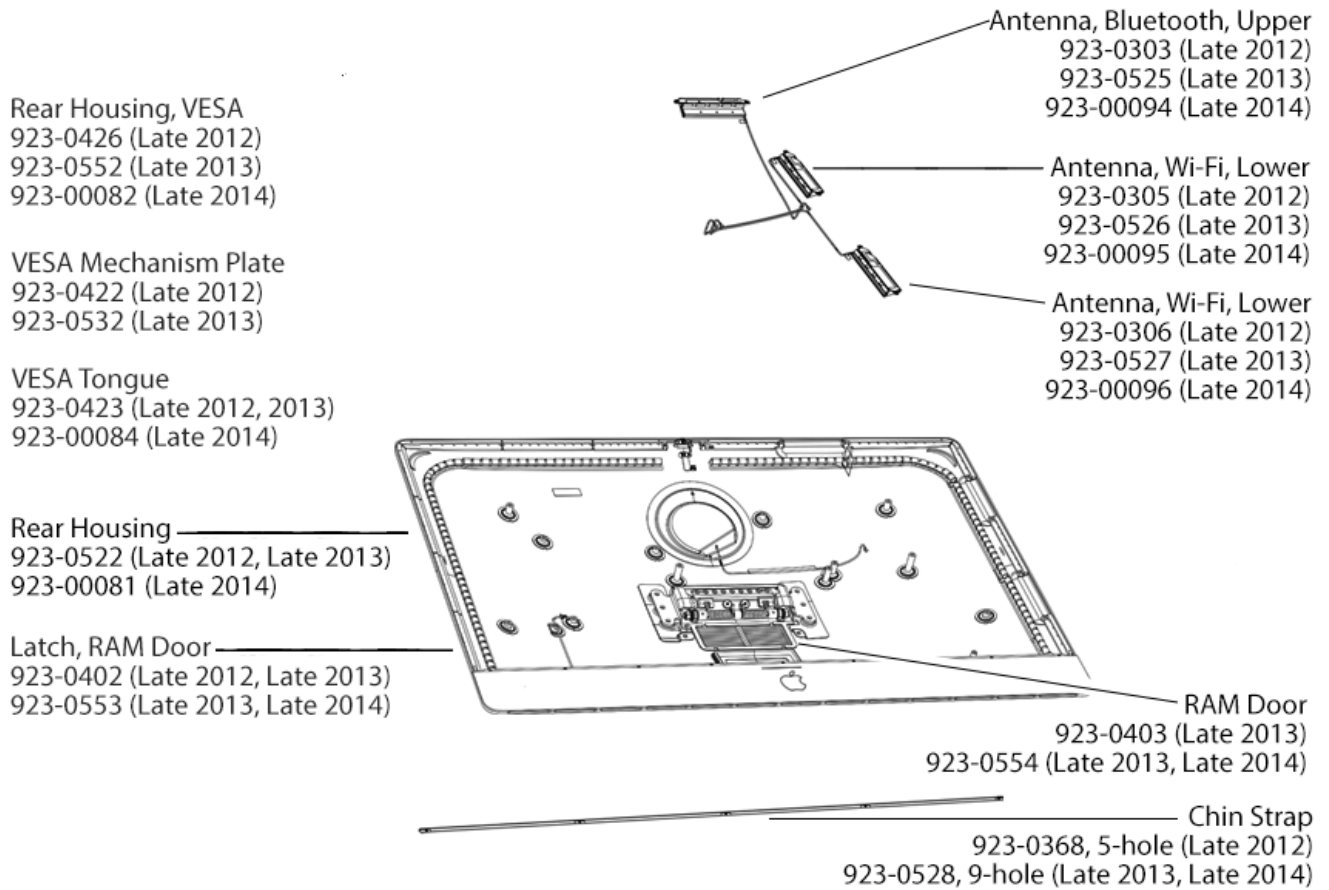
## Exploded View 1

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014):



## Exploded View 2

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014):



## Exploded View 3

iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014):



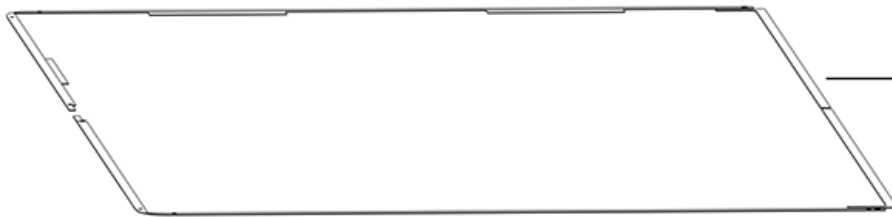
Display Panel  
661-7169 (Late 2012, Late 2013)  
661-7885 (Late 2013, Early 2014)  
661-00200 (Late 2014)



Cable, Embedded DisplayPort  
923-0308 (Late 2012, Late 2013)  
923-00093 (Late 2013, Early 2014)

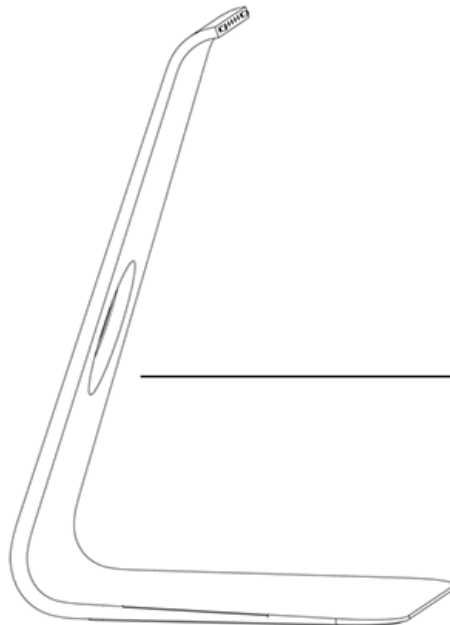


Cable, Thermal  
923-00093 (Late 2013, Early 2014)



076-1444 Kit, Start, LCD Display Panel  
- Display removal tool handle  
- Display removal wheels (2)  
- VHB strips (for both sides)  
- Service wedge

076-1419 Kit, Display Panel Removal  
(Late 2012, Late 2013)  
- Display Removal Tool  
- VHB Strips (2)  
- Display removal wheels (2)



076-00009 Kit, Display Refill (Late 2012, Late 2013)  
- Display Removal Tool  
- VHB Strips (2)  
- Display removal wheels (2)

923-0299 (Late 2012, Late 2013)  
923-0529 (Late 2013, Early 2014)  
923-00083 (Late 2013, Early 2014)

#### Not Shown:













- Kit, Display Extension Cable Set  
076-00010 (iMac Retina 5K, 27-inch, Late 2014)

- Kit, Display Extension Cable Set  
076-1431 (iMac, 27-inch, Late 2013)



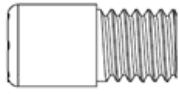
# iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Screw Chart

**Note:** Screws are not to scale.

<b>923-0328</b> T6  SSD (1)	<b>923-0329</b> T8  Stand (7)	<b>923-0331</b> T10  Logic board (5), Power supply (2), Hard drive bracket (4)
<b>923-0332</b> T10  Fan (3)	<b>923-0333</b> T10  Right speaker, Left speaker (2 per speaker)	<b>923-0334</b> T10  Mechanism (6)
<b>923-0338</b> Phillips #00  Chin strap: iMac Late 2012 (5) iMac Late 2013 (9)	<b>923-0304</b> T4  Wi-Fi/Bluetooth antennas (2 per antenna)	<b>923-0396</b> T10  Power supply (2), Logic board (3)
<b>923-0339</b> T5  Camera (2)	<b>923-0394</b> T5  Wireless card (2)	<b>923-0395</b> T10  Heat sink

**923-0377**

T8, 8.13mm



Hard drive (4)

**923-0399**

T25, 13.84mm

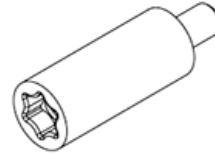


Power supply standoff (1)

**923-0521**

T25, 20.81mm

**Note:** Use only the 9-hole count on chin/rear housing 923-0522.

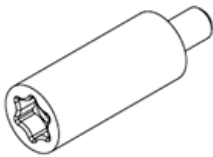


Hard drive standoff (1)

**923-00097**

T25, 20.81mm

**Note:** Use only with rear housing 923-00081 (Retina 5K, 2014).



Hard drive standoff (1)

**923-0520**

T25, 20.81mm

**Note:** Use only the 9-hole count on chin.



Power supply standoff (1)

**923-0404**

T5



RAM access door latch(4)

**923-0418**

Pentalobe



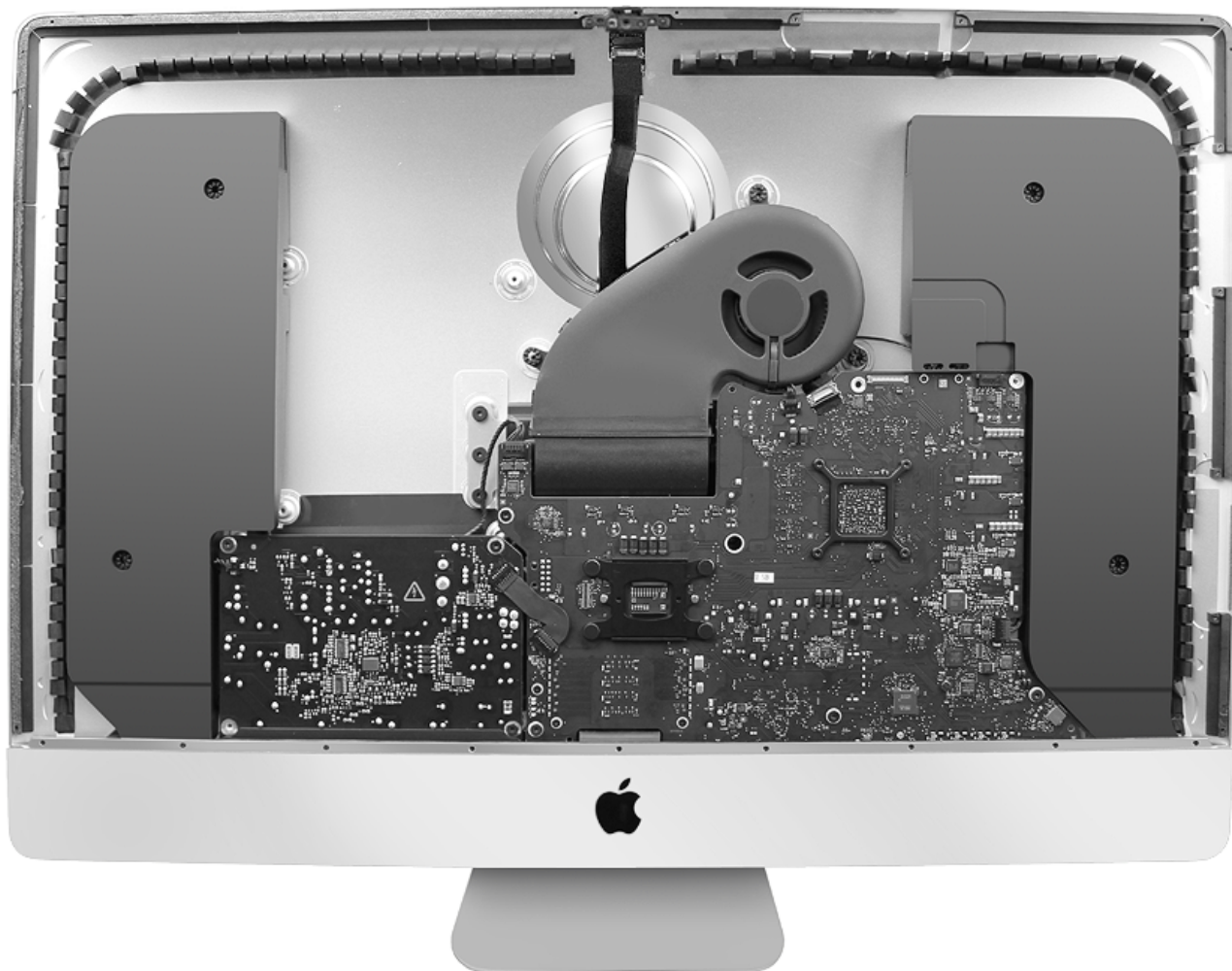
VESA (2)

## iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): Internal Views

iMac (Retina 5K, 27-inch, Late 2014)



iMac (27-inch, Late 2013): Flash Storage Configuration, No Hard Drive

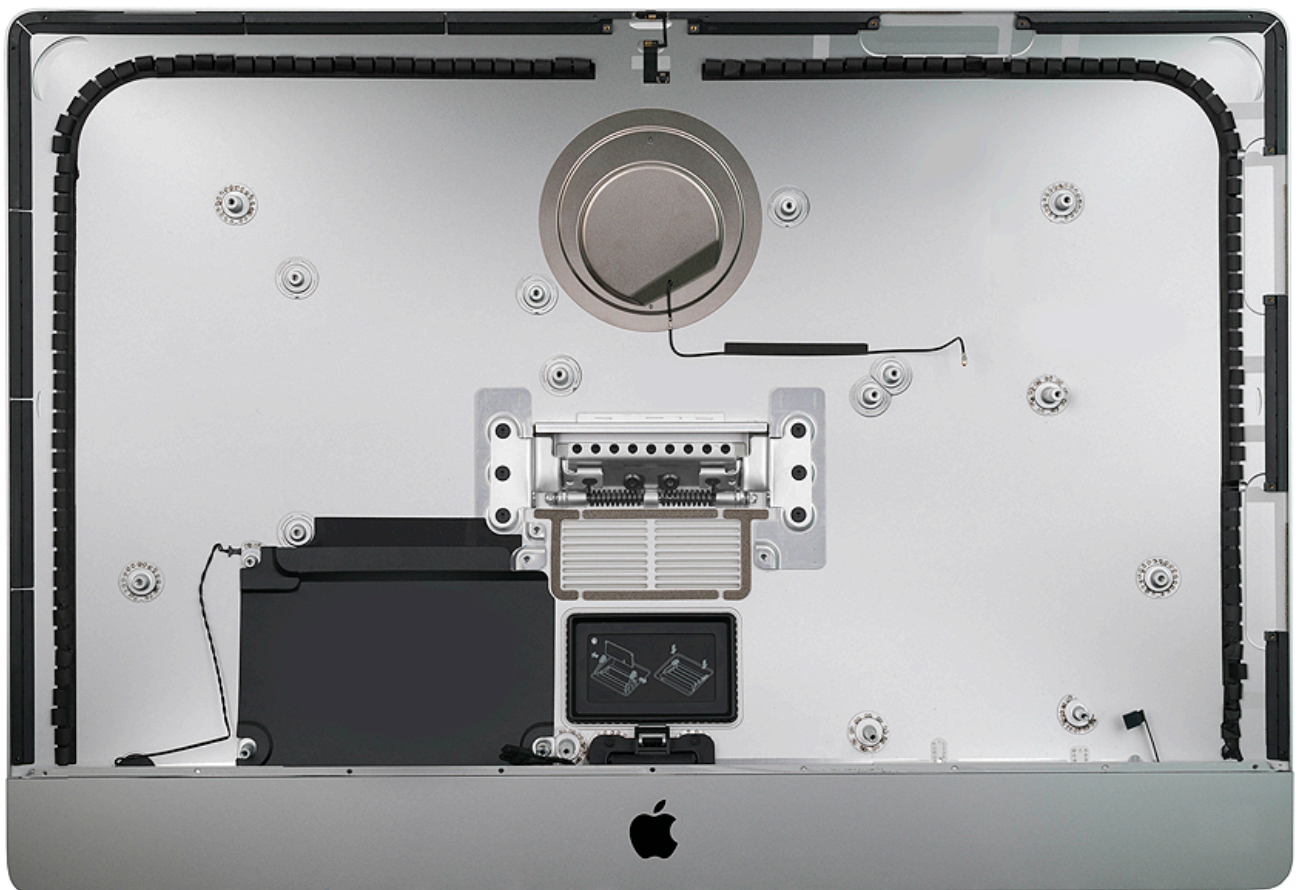


**iMac (27-inch, Late 2012)**





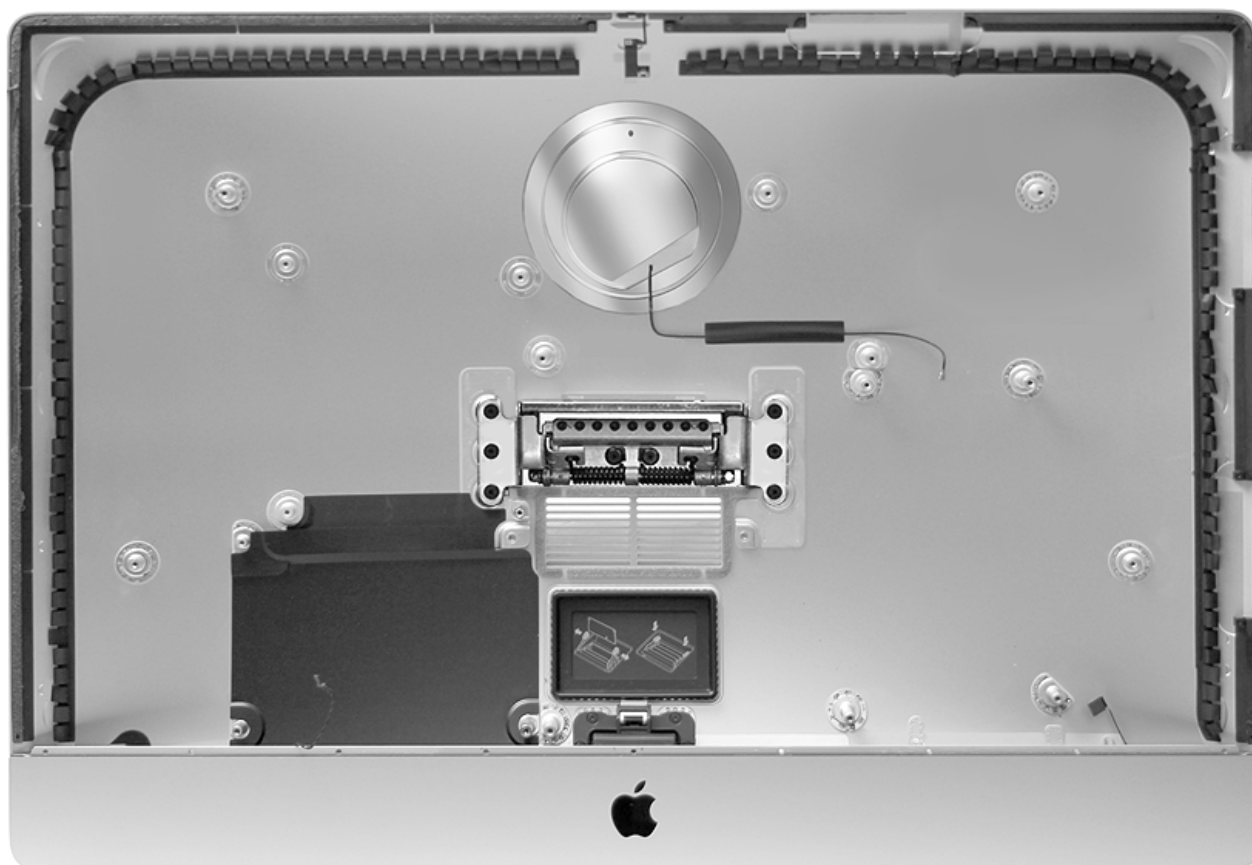
**iMac (Retina 5K, 27-inch, Late 2014) Rear Housing (9 holes on chin)**



**iMac (27-inch, Late 2013): Rear Housing (9 holes on chin)**

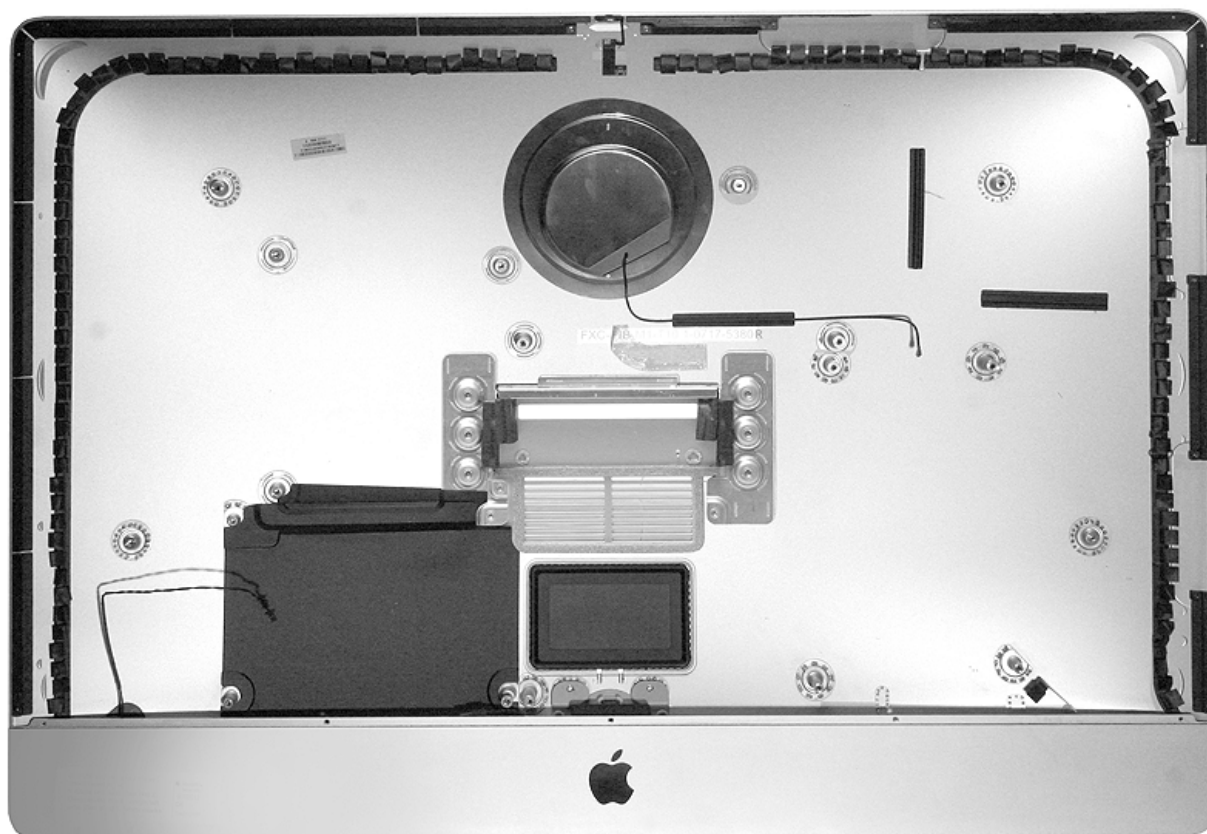


**Note:** The 9-hole chin strap is included with the rear housing.



#### iMac (27-inch, Late 2012) Rear Housing (5 holes on chin)

**Note:** This part is being replaced by the 9-hole rear housing (923-0522).





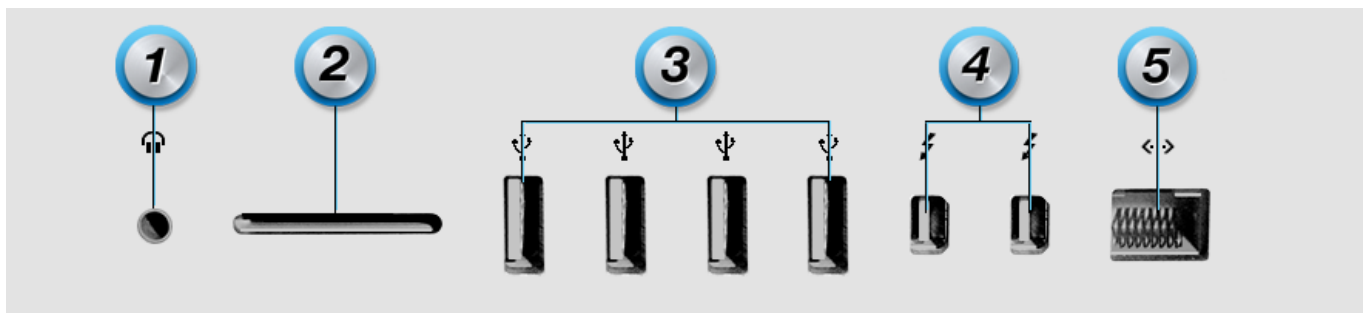
**iMac (27-inch, Late 2012 and Late 2013) and iMac (Retina 5K, 27-inch, Late 2014): External Views**



**Rear View and Ports**



## Ports



1. Headphone
2. SDXC card slot
3. USB 3 ports (4)
4. Thunderbolt ports (2)
5. Gigabit Ethernet port (10/100/1000 Base-T)

## Power Button



**RAM Access Door**





## Service Guide Feedback

This escalation path is intended only for content issues with Service Guide articles that begin with the prefix IT, RP, SD, SM, SV, or TP.

Please provide a clear and concise description of the content issue you encountered and steps to reproduce. Other information that helps us help you:

- Article number(s)
- Serial number(s)
- Screenshots or screen recording

For issues with article content, email the **AppleCare Service Documentation** team at **serviceguides@group.apple.com**.

For issues with video content or playback, email the **AppleCare Media Production** team at **servicevideos@group.apple.com**.

**Note:** You may not receive a response, but all comments will be reviewed and investigated as needed.